SCIENTIFIC AMERICAN

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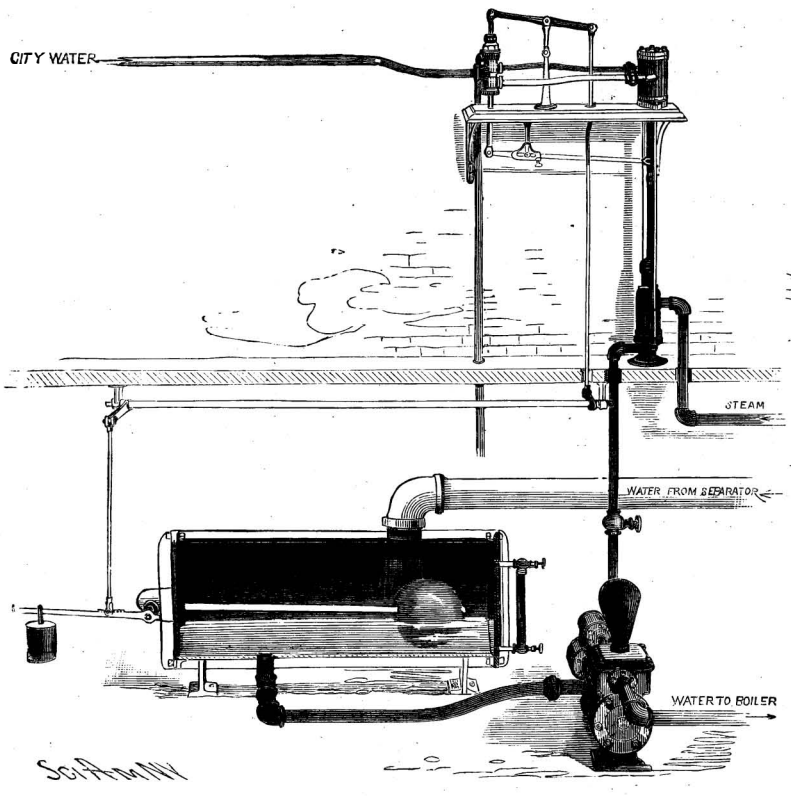
WEEKLY.

ALLIS STEAM ENGINES, OILING SYSTEM AND SUBSIDIARY APPARATUS IN THE EASTERN POWER HOUSE OF THE BROOKLYN CITY RAILROAD CO.

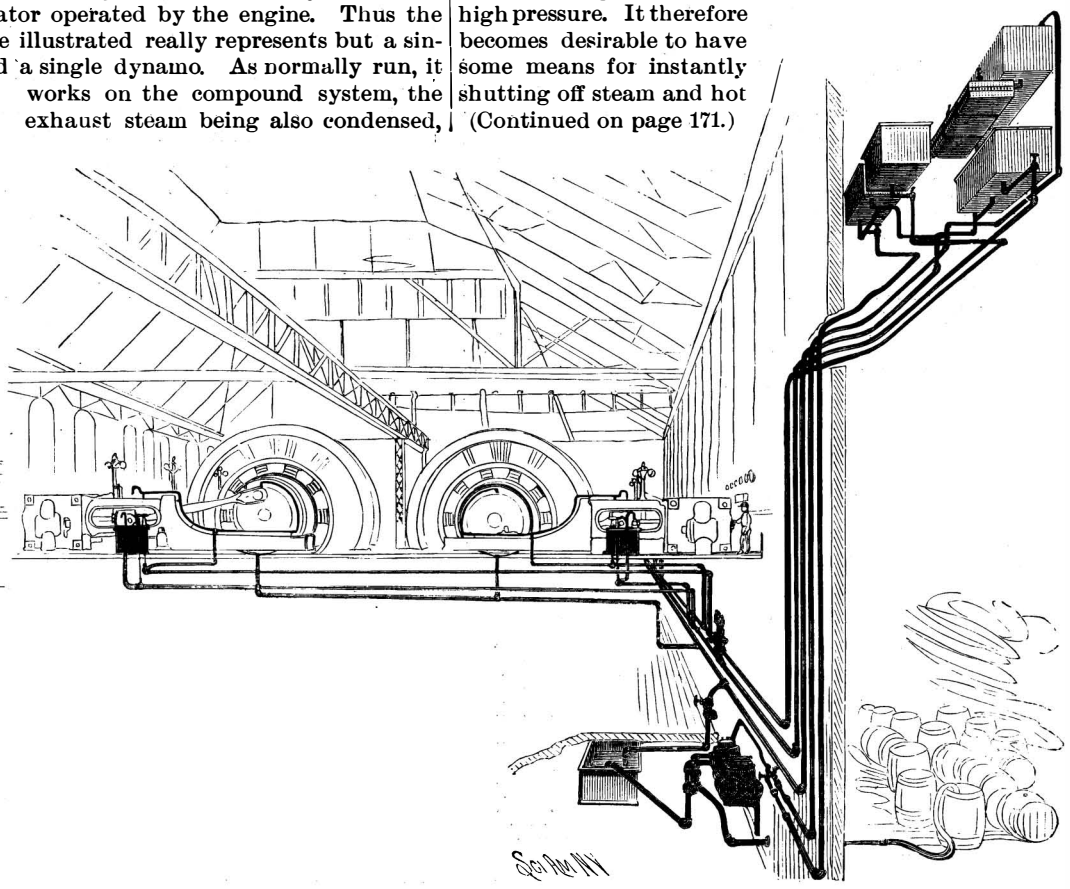
Not the least impressive apparatus in the Eastern Power Station of the Brooklyn City Railroad Co. which was illustrated by us in our issue of Sept. 8, is supplied by the engines, of one of which we present a view in the present issue, designed to illustrate the general disposition and relations of parts to each other and to the dynamo which the engine drives. One compound cross-connected engine is shown. In front on the right hand is the high pressure cylinder with the cut-off governor; on the left is the low pressure cylinder with the speed-regulating governor. It will be remembered that we described the governor on the high pressure side as operating to close a throttle valve whenever a definite speed is exceeded, while the governor on the low pressure side regulates the engine in the usual way. The two cylinders are connected one with another by a main beneath the floor of the engine room. Between the two bed plates comes the fly wheel and electric generator operated by the engine. Thus the great structure illustrated really represents but a single engine and a single dynamo. As normally run, it works on the compound system, the exhaust steam being also condensed, but should an emergency arise either cylinder can be worked alone, on a condensing or a non-condensing system as desired. These engines, of which there are now four in place in the station, were built by the Edward P. Allis Company, of Milwaukee, Wis.

The boilers in the station are of the Babcock & Wilcox type, and occuppy considerable height, and the water level being some feet above the reach of a workman standing on the floor. They are run at very high pressure. It therefore becomes desirable to have some means for instantly shutting off steam and hot

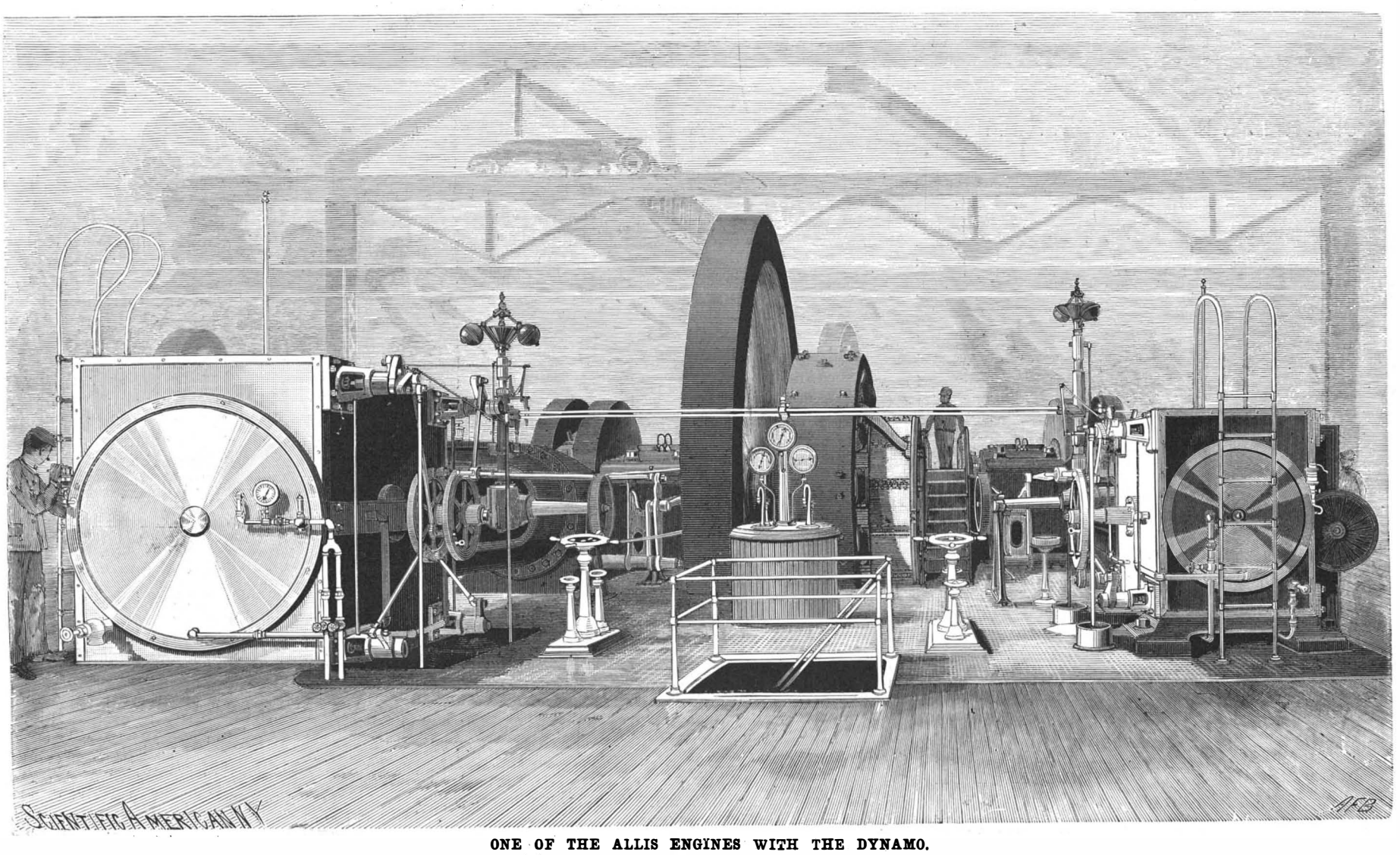
(Continued on page 171.)



VALVE CONNECTIONS FOR CONDENSED WATER TANK



OILING SYSTEM FOR ENGINES.



ONE OF THE ALLIS ENGINES WITH THE DYNAMO.

THE EASTERN POWER STATION OF THE BROOKLYN CITY RAILROAD COMPANY.

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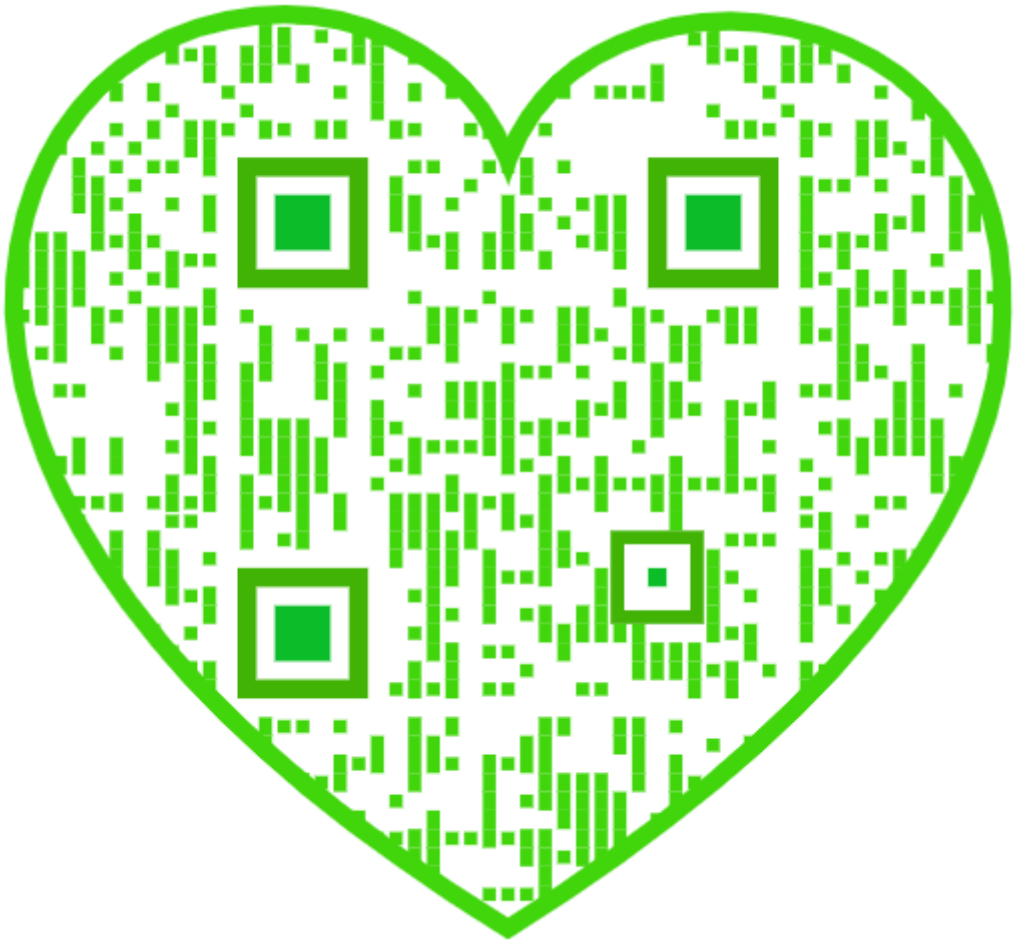

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THE FOREST FIRES.

During the last few days it seems as if the forests were avenging themselves on wasteful man. Forest fires of the most extensive description have taken place in Wisconsin and Minnesota especially, and a death list of between 600 and 1,000 people indicates the appalling extent of the calamity.

These were not only deaths from exposure or other accident, but comprised hundreds of people who were absolutely burned to death. The fires occurred in a thickly wooded region, the seat of an extensive lumber industry, and the flames once started spread rapidly through the country, eye witnesses describing the flames as rolling billows, while the noise they made was such as to induce some people to believe that they were threatened with a cyclone.

The loss of timber is put at nearly a thousand millions of feet. The area of the fire-swept district cannot be accurately stated. In one stretch of the burned territory, 25 miles long and from 1 to 15 miles wide, but one house was left standing, the general shape of the district being like a very long ellipse with branches extending to the northward from it.

The inhabitants generally took the course of fleeing for their safety to water courses, lakes and swamps, where they immersed themselves in the water. Those who were already burned sought to alleviate their sufferings by the application of mud, and some used the mud as a protective agent. They are described as applying successive coats of it, as it baked on, to protect themselves from the heat of the forest burning along the shores. As is so often the case in great emergencies, the heroism of railroad men appeared. One man, agent of the Eastern Minnesota Railroad at Sandstone, a town a short distance from Kettle River, was at the telegraph instrument when the eastern train carrying 500 refugees went into Sandstone. He flagged the train and sent it back over the bridge across Kettle River, thus probably saving the train from conflagration, and preventing the death of perhaps all its passengers.

The unfortunate people of Sandstone saw the fire four hours before it reached the place and had everything packed up in readiness to move to Kettle River, but before they were aware of their real danger, the fire came in at three sides at once and the town was ablaze. In thirty minutes more it was swept off the face of the earth.

The town of Hinckley, Minn., one of the principal sufferers, was the scene of a deed of great courage and endurance on the part of the railroad engine runner J. P. Root, who figures as one of the heroes of the fire. His train on the St. Paul and Duluth road passed through Hinckley just before it took fire and went on a couple of miles to Mission Creek. This place was in ashes. The conductor Sullivan at once issued an order for the train to back to Hinckley, but before it could be reached, Hinckley was in flames. The train stopped at the depot one minute, enough time for it to catch on fire. Two hundred panic-stricken people rushed on board of it and the train immediately backed away, the only chance of safety being to go away from the town to water. The engineer and fireman stood at their posts and the rest of the train crew did the same, while every car was on fire. Crowded with frightened people, the flames growing hotter with the motion, it backed six miles to Skunk Lake and stopped, and the passengers rushed out into the water.

The conductor, who throughout the terrible six miles had acted the part of a hero, collapsed here and lost reason. The fireman during the run had dipped water out of the water tank and kept throwing it on the engineer as he stood at his post, and sometimes himself jumped bodily into the tank. At Skunk Lake the engineer had hardly strength to get off the seat, and he fell on the foot-board exhausted, burned, and bleeding. He was carried to the water and placed prostrate in it.

The scene in the burned regions can be imagined. The railroad tracks and other places were at one time strewn with dead bodies of the burned. Cattle of all kinds shared the same fate, and their remains were scattered through the charred district. The smoke in many cases, even where there was no immediate danger, was so dense that nothing could be distinguished 100 yards away. Besides J. P. Root, the engineer, there are many other examples of heroism. A West Duluth boy of but 14 years old dragged two smaller children miles along the railroad away from destruction. A young man carried his sick betrothed for a mile through the flames, while others walking beside him lay down to die, giving up the fight. From the position of many of the bodies it was surmised that they had died while rushing into the heat of danger to save others.

Cornell University is reported to have been a heavy loser in the fire by destruction of timber on forest lands owned by it.

In suddenness and in extent of loss of life and property the disaster is comparable with the Johnstown flood, it seeming as if water and fire in the two cases respectively were striving to see which could inflict the greatest loss. But while this fire will go down in history as one of the world's great disasters, it should be remembered that it is but one of many fires. Our woodlands, limited in extent and remorselessly drawn upon, suffer more from fires than from cutting, and the fires are in many cases started by carelessness or wantonness.

The Action of Light on Organic Colors.

The committee having this matter in hand, in reporting to the Chemical Section of the British Association on their work during the past year, state: During the year a large number of wool and silk patterns, dyed with various natural and artificial orange and yellow coloring matters, have been examined with respect to their power of resisting the fading action of light. The patterns were exposed at Adel, near Leeds, in the grounds of Mr. James A. Hirst. Each dyed pattern was divided into six pieces, one of which was protected from the action of light, while the others were exposed for different periods of time. On silk the relative fastness of the various colors was, for the most part, the same as on wool; the differences being unimportant. Orange and yellow patterns give a comparatively large number of satisfactorily permanent colors. In the more or less fugitive class were to be found all the basic colors, all the nitro phenols, with the exception of palatine orange, and all the bright yellows derived from the natural coloring matters by means of aluminum and tin mordants, with the exception of those obtained from weld. Comparatively few azo colors were met with in this group. By far the greatest number of yellows, ranging from "moderately fast" to "very fast," were to be found among the azo colors. Specially important were those in which salicylic acid was a constituent element, since not only did this impart to the color the power of forming more or less stable lakes with chromium and aluminum mordants, but it appeared frequently to give the colors the quality of fastness to light, even when no mordant was applied. The colors obtained with aluminum were practically as fast as those fixed with chromium, since the first named mordant gave much brighter and purer yellows. The tin mordant, so useful in the production of the most brilliant orange and yellow colors obtainable from the natural coloring matters, seemed, however, to be of little or no advantage in connection with most of these azo mordant colors, no doubt because they were susceptible to the reducing action of the mordant usually employed for wool—viz., stannous chloride. Very interesting in point of fastness to light were the azoxy colors, and although unfortunately apt to dye wool somewhat irregularly, giving speckled looking colors, they were admirably adapted for silk and cotton. Another interesting little group was that which includes tartrazin, a color not only noteworthy for its fastness to light, but also because of its brilliancy and purity.

The fastness of alizarin orange was worthy of special mention, for it was probably greater even than that exhibited by most other colors of the alizarin group, and it showed the peculiar darkening action exerted by the light, probably in consequence of the presence of the nitro group. It was remarkable how few really fast yellows were derived from the natural coloring matters, and these were chiefly the olive yellows obtained with chromium mordant. The only fast, and at the same time bright, natural yellows were those derived from weld, and since this dyestuff was now of little general importance to the dyer its cultivation had become extremely limited, and was gradually being given up. It was fortunate, therefore, that science had been able to replace it by efficient substitutes, so far, at least, as permanency toward light was concerned. The experiments had already abundantly proved that the popular opinion that the coal tar dyestuffs included only such as yielded more or less fugitive colors was entirely false; indeed, it was perfectly safe to assert that coal tar was the source from which the greatest number of colors fast to light were derived at the present time and this seemed to be specially true of the red and yellow colors.

Preservation of Railroad Ties.

An experiment on the Atchison, Topeka and Santa Fe Railroad, dating back to 1881, which shows that 40 per cent of fifty Colorado pine ties were yet in the track after 11·83 years' exposure, indicates that the average life of ties treated by the zinc tannin process will not be less than 12 years.

Unprepared oak ties cost about 53 cents each, and some 25 cents more for hauling, distributing and laying, making a total of 78 cents each. Hence, as they last 8 years, their average annual cost is 9·66 cents The Burnettized ties are said to cost 72 cents each under the like conditions, and, as they last 12 years, the average annual charge is 6 cents, thus indicating an economy of 3·66 cents per year per tie, or, when 2,640 are laid per mile, of $96 per year per mile of track.

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Wood Piercing Insects and Birds.

BY H. C. HOVEY.

In the fifth report of the United States Entomological Commission, by Dr. A. S. Packard, may be found a full description of most of our forest pests. More recently the subject was treated by Prof. A. D. Hopkins, entomologist of the West Virginia Agricultural Experiment Station, in the official bulletins for last January and February. Considerable time was given to discussing wood-piercing insects and birds during the scientific meetings in Brooklyn in August; both in the botanical section of the A. A. A. S. and in the American Forestry Association, in which Mr. Hopkins, Hon. G. W. Minier, Major Jed Hotchkiss, Hon. B. E. Fernow, and others participated. What is now attempted is merely to put in a popular form some of these scientific facts and conclusions.

Every thoughtful person must feel a degree of alarm at the rapid disappearance of our American forests. The ax, the torch, and other foes that might be named, will soon disrobe our hills and compel costly expedients to be resorted to in order to replace what is being so recklessly destroyed. We should welcome any information that will help us to maintain our natural forests, or to plant successfully cultivated groves, or that will augment the utility, beauty or value of our existing woods. Beetles and grubs may not make the sensation caused by a forest conflagration, nor do they endanger human life. Yet the reports show that these minor causes destroy annually many million dollars' worth of valuable trees and lumber. For instance, only four years ago, the pine bark beetle invaded the pine lands of Virginia, and the result now is that hundreds of thousands of acres of forest are killed as effectually as if it had been done by a conflagration. Similar devastations are reported from portions of New York, New England, and the Maritime Provinces. It is high time for us to pay attention to wood-boring insects and their enemies.

There is a difference in the habits and methods of these insects; some attacking the healthy wood of thrifty trees, others the substance of injured trees, and others, again, only dead wood, or logs and stumps. The sap wood alone is perforated by certain species, while others pierce the sound heart of the tree. The wormholes vary in diameter from the one-hundredth of an inch to an inch or more, and in length from half an inch to many feet. In many cases they are subsequently enlarged by wood ants, or by the process of natural decay. Minute perforations called "pin holes" are often found in otherwise sound oak and chestnut wood, which are a serious injury to square timbers, planks, staves and headings. These are made by larvæ armed with horny gouges, the young of certain winged beetles. They pierce through to the heart wood, while other kinds stop in the sap wood. The latter are usually the adults, however, instead of the young, the tiny beetles burrowing nests, or even extensive galleries, for the purpose of depositing their eggs. The brood remains imprisoned till matured, when it emerges to repeat the work of destruction on new material. How great that destructive work is in the aggregate it is impossible now to say, owing to our meager knowledge of facts. By some the depreciated value of the annual lumber output is estimated at fully fifty per cent, and in some cases it is said to reduce the cash returns below the cost of production, while others report comparatively slight loss from the causes indicated.

But the important and hopeful thing to be said is that, by simple and comparatively inexpensive measures, a large per cent of this immense loss can be prevented. Experiments are being made as to the introduction of friendly parasites that shall rid our woods of hostile insects. Suggestions have been made as to steaming the infested timber, and other direct modes of attack. But meanwhile much may be done, in a preventive way, by improved methods of managing standing trees, logs and stumps, and manufactured lumber.

It seems to be generally conceded that forest beetles will not deposit their eggs on sound living trees, but only at places where a tree has in some manner been wounded. This indicates that they may be repelled from such places by suitable applications. But this is at present practicable only in groves under cultivation.

But it has also been observed, by Mr. Hopkins and others, that the beetles will not lay their eggs on dead trees, logs, or stumps from which the bark has been removed. Lumbermen know perfectly well that trees felled in certain months will lie for years without being infested by insects; while others felled at a different time of the year will be worm-eaten at once. Usually, even quite intelligent lumbermen will attribute this remarkable difference to the mysterious influence of the moon. But the true reason, and that of which due advantage should be taken, is that while trees felled about the time when the beetles are laying their eggs are almost sure to be attacked; those felled a little later will certainly escape for that year, and will probably offer no attractions to the invaders by another year, owing to their changed conditions. The rule as laid down by the West Virginia Agricultural Bulletin is:

"Take the bark from all logs and felled trees cut between October and April 1, that will have to lie more than one month after the latter date before being converted into lumber, and from all cut between April 1 and October, unless they can be made into lumber immediately after the trees are felled."

It might be added that stumps, strippings, and other rubbish of the logging camp, or the clearing, should be burned as soon as possible, for the sake of the living trees in their vicinity. Adherence to these simple rules would save our country millions of dollars' worth of timber every year, by preventing its destruction or deterioration.

Among other methods that have been suggested is the fostering and multiplication of friendly birds that are known to feed on the hostile insects. These allies are especially valuable in warding off those forest pests that are known to attack growing trees. No one can doubt that the woodpeckers, for instance, obtain a large share of their food from the insect world. But, on the other hand, it is asserted that the woodpeckers fail to discriminate between pernicious insects and their parasites. It has been determined that the Clerid beetle is the worst enemy of the European bark beetles, and also that the woodpecker is the greatest foe of the friendly Clerid. But, after all, the conviction is firm in our minds that the birds are among our best friends as insect destroyers, and ought accordingly to share our protection. Their mission in the economy of nature is to thin the ranks of a vast army by which, without their aid, we should be overwhelmed, and our forests would be hopelessly ruined.

Some highly suggestive facts have been brought to light by recent investigations as to the conditions of wood resulting from the work done by the Columbian timber beetle. It seems that this insect prefers to attack the healthy sap wood of living trees, where it excavates its galleries and develops its brood without affecting the vitality of the tree. The result of its attack on the oak, birch, tulip, and other trees is of economic interest. The wound made stains the wood above and below it. In white oak the stain extends only a few inches, while in tulip trees the stain may be several feet in length. The stained wood is not unsound, nor is its quality impaired even for a century or more. The stain is caused by a colored liquid proceeding from the wound made by the beetle, and is fully effected within twelve months. Singularly the result does not follow the wounding of dying trees, even when their wood is sound; which shows that the movement of the sap promotes the spread of the coloring matter.

The observations made by Mr. Hopkins as to the habits of the woodpecker, commonly called the sapsucker (Picus pubescens), have convinced him that he pecks the bark altogether for the sap. The punctures thus made at different stages of the tree's growth correspond to the succession of elevations and depressions visible in the annual layers of wood. This is the cause of the beautiful bird's eye poplar. If a lumberman wants it, let him select logs whose bark shows the most work done by the sapsucker.

Possibly the bird's eye maple is due to the same cause. At least it is well known that the sapsucker is extremely fond of the sap of sugar trees, whose bark it pierces by numerous rows of holes for the purpose. A single bird has been known to make a hundred punctures in the same tree in one season. Sometimes this wounding causes decay. But if otherwise, it is possible that the healed cicatrices are what make the curly maple. The subject is certainly of sufficient interest to demand further investigation.

Nihilist Inventions.

The French War Office seems to be the target for all inventors, intelligent and otherwise. Just now it is occupied with the project put forward by M. Turpin, the chemist, for the wholesale massacre of the enemy in the next great war. One luminary, however, soars to greater achievements, and proposes that the Minister of War should subjugate and train squadrons of horseflies. These novel warriors, it is suggested, would be fed on blood smeared beneath a thin skin covering on dummy figures dressed as soldiers of the Triple Alliance. When diplomatic relations were near breaking point, the flies would have the juice of certain poisonous plants added to their daily food, and when war should be declared, the French army would merely have to send them as an advance guard in the path of the enemy. The inventor of this idea seeks to protect it by a patent. A photographer is responsible for the discovery of a project for obtaining plans of the enemy's fortifications. Of course, the invention is exceedingly simple and can, naturally, be easily carried out. It takes the form of a captive shell, made to explode over fortresses, etc., and containing a small camera attached to a parachute. The enemy's fortifications would be photographed instantaneously, the apparatus hauled down like a kite, and the only remaining operation would be to develop the plates. Another inventor thinks that explosive bullets filled with pepper would have the twofold result of blinding the enemy and fostering French trade with its colonies; while a fourth inhuman being fancies that poisoned needles, sent to the enemy's camp by a sister of mercy, would have the effect of poisoning the soldiers' fingers, thus rendering them hors de combat.

Coloring Photographs.

All readers of photographic literature are cognizant of the attempts that have been made to produce pictures direct in natural colors. No matter how satisfied the experimenters may be with the results of their labors, the fact remains that, as yet, these results are not of practical value. If a colored photograph is wanted, the professional photographer must have recourse to brush and colors in order to imitate nature.

In the coloring of photographs several improvements have recently been made, and we will endeavor to give some practical hints on the technical part of the process, leaving the artistic side to some other writer.

Prints are seldom made upon salted paper, but mostly on paper coated with some other material, which gives more detail and brilliancy, while increasing the difficulty of coloring. The smooth surfaces of the Aristo papers, for instance, will accept hardly any water color, while the coating of gelatine emulsion papers is easily injured by moisture. These evils can only be removed by suitable preliminary treatment. The following method has proved to be of real practical value: Gelatine prints, which would suffer by moisture, are treated with alum after fixing. After being mounted and retouched with albumen colors, the picture is flowed with filtered albumen, to which a few drops of ammonia have been added. When fairly dry, it is passed through a burnisher. The albumen, if not previously completely coagulated, will now become sufficiently solid for use. This albumen coating admits of the use of all water colors.

For Aristo and all collodion paper no preliminary preparation is required for transparent colors, but when using water colors it is necessary to give a coating of varnish. The picture preserves its brilliancy, and the coloring matter may readily be applied.

In the coloring of photographs a distinction is made between covering and transparent colors. The former are the ordinary water colors in tubes or cakes, while the transparent colors are liquid. By a careful combination of the two, the most brilliant results are obtained. The colors are applied in such a manner that all the half tones and details of the picture are covered with transparent colors, while the deep shadows are painted with a covering color, to which some albumen may with advantage be added. In the category of covering colors we may list cobalt, Prussian blue, cadmium yellow, yellow ocher, green earth, Mars yellow, India red, umber, burnt sienna, and Chinese white. The finely powdered colors are mixed with a suitable binding medium, preferably—

Filtered albumen	100 c. c.
Ammonium carbonate	5 grammes.
Glycerine	3 c. c.
Liquid ammonia	4 "
Water	25 "

This mixture, if well cooked, will keep a long while, and answers all requirements. The colors thus prepared adhere well, are sufficiently transparent, and may even be burnished. The transparent colors may be worked without considering light and shadow, these being sufficiently well marked in the print. The coloring of the flesh is sometimes rendered difficult because of the spotting, which may be removed by the paint. The previous application of a little albumen is recommended. The background requires particular care. It should be well graded, and should harmonize in color with the subject. Greenish-gray and medium gray colors may be used with advantage. The gold ground is also used quite frequently as background. This can be made quite easily by coating the background with thin mastic varnish, following the outline of the figure. When half dry, powder it uniformly with fine gold bronze. When the varnish has become thoroughly dried, remove with a brush the excess of gold bronze. Backgrounds with distinctive design should be painted in a subdued tone.

Albumen prints can also be treated with covering colors. It is only necessary to collodionize the colored picture. For this purpose use a 3 per cent plain collodion. Such a picture can be burnished. Collodion prints do not require any such treatment; indeed, flowing with collodion would be injurious.—J. Joe, in Anthony's Bulletin.

A Balloon Struck by Lightning.

While the Duke and Duchess of Connaught were inspecting the performances of a military balloon at Aldershot on Sept. 5, the balloon was struck by lightning, which followed the anchor wire to the earth and seriously injured three men who were holding the wire. The duke rushed to the assistance of the unfortunate men, who were shrieking with the agonizing pain their contact with the wire caused them. They were released from their predicament and taken to the hospital, not mortally hurt.

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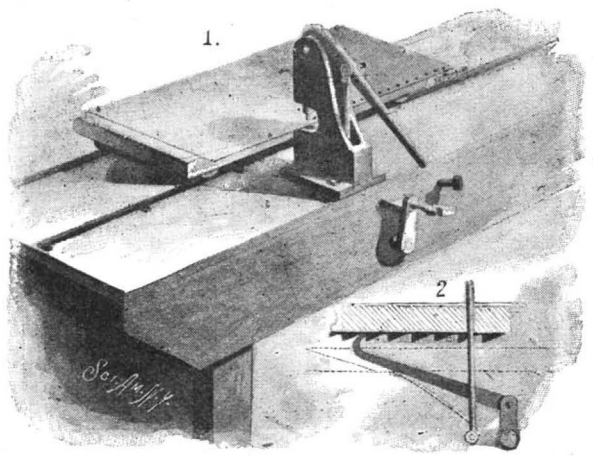
AN IMPROVED METAL PUNCHING MACHINE.

A mechanism designed to operate efficiently in punching metal sheets, properly feeding forward the work, has recently been patented by Mr. Richard Walsh, of Sherman, Texas, and is shown in the accompanying illustration. A carriage traveling on guideways on a suitable bench has at two corners pins to engage apertures in the sheet to be punched, to hold it in position, the punch being secured on the bench at one side of the carriage, and being operated by the usual cam or punch lever. The latter is connected by a link with an arm on a transverse shaft on whose outer end is a crank arm or handle, while near the



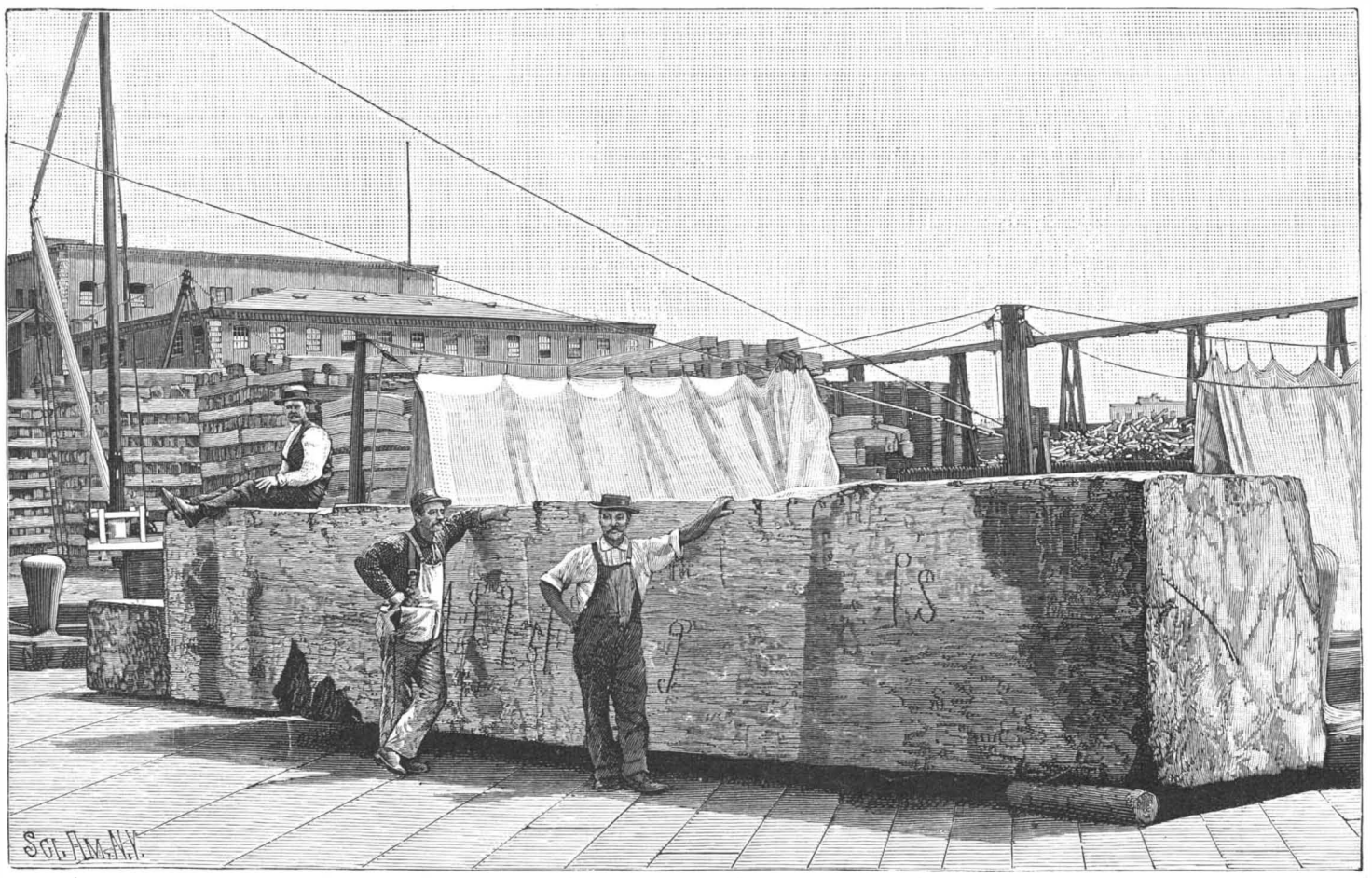
WALSH'S PUNCHING MACHINE.

inner end of the shaft is an arm pivotally connected with a pawl held up by a spring, as shown in Fig. 2, to hold the pawl in engagement with a toothed bar on the under side of the carriage. The punching of the sheet alternates with the feed of the carriage, which is effected by the movement of the lever or the operation of the crank arm, the latter having a limited motion in a bracket on the front of the bench. The feed may be regulated by throwing the pawl out of engagement with the toothed bar, for which purpose an obliquely sliding pin is arranged in the front of the bench, the inner end of the pin being beveled, and, when pushed inward, holding the pawl down out of engagement with the toothed bar.

MAMMOTH BLOCK OF MAHOGANY.

The largest log of mahogany ever imported into the United States was received at Messrs. Nesmith Brothers' mahogany and cedar yard, Greenpoint, N. Y., on the schooner Laguna, of Port Jefferson, N. Y.

The log, measuring 44 feet 4 inches long, 60 inches by 56 inches at the base and weighing 21·66 tons, was felled in the Sierra Chisee, in Guatemala, and floated down the Rio de la Pasion and Rio Usumucanto to Laguna, Mexico, a distance of over 300 miles. It was to have been sent to the World's Fair, but all vessels refused to carry it. After lying at Laguna over a year the log was sawed in two and Captain S. S. Bayles took it aboard his vessel and brought it to this city, where it was inspected and measured. A fair idea of the enormous size of this block may be obtained from the engraving, which represents it after it was cut in two for delivery and shows only about half its original length. Those who have a fancy for inviting their friends to stretch their legs under their own mahogany would here have a chance of procuring a table 22 feet 6 inches long and 5 feet wide, made of one solid piece, at which thirty-two guests could be seated without crowding. Twenty-eight such tables each two inches thick could be cut from this magnificent piece of wood.



A MAMMOTH BLOCK OF MAHOGANY.

Phosphorescence.

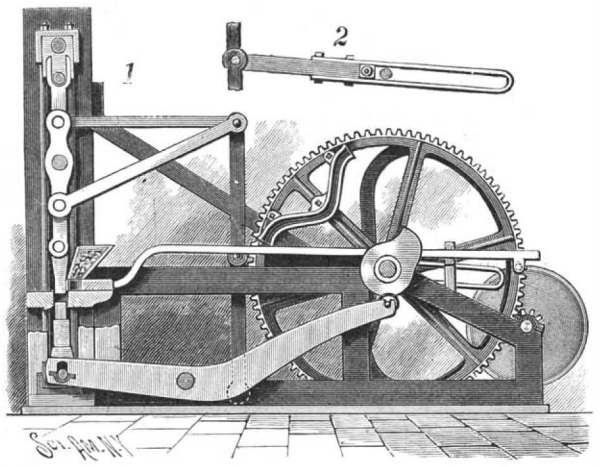
At a recent meeting of the Chemical Society, at the Royal Institution, Professor Dewar gave an account of the researches he has lately been carrying out in connection with the behavior of substances exposed to light at a temperature of 180° below zero. In the course of these, he found that the apparatus with which he was working was phosphorescing brightly; and he was thus induced to study phosphorescence itself at low temperatures. Naturally the question presented itself of the relation of phosphorescence to structure. The professor therefore experimented with various definite organic compounds. A hydrocarbon like paraffin was feebly phosphorescent at ordinary temperatures; at low ones, it was brilliantly so. Many of the complex compounds known as ketones were exceedingly luminous—acetophenone, for instance. One of the most beautiful phosphorescing bodies was the complex salt the platino-cyanide of ammonium, which shone with a splendid green light. Professor Dewar's experiments led him to the general conclusion that the more complex a body is in structure, the more likely is it to phosphoresce, perhaps because, in some way, its structure enables it to take up the light vibrations with more facility. The capability of oxygen for phosphorescing is another very curious fact. In the gaseous state, it can be made to glow if exposed to an electric spark while rushing into a large vacuum tube. This property is shared by its compounds, but is not possessed by hydrogen or any other gas.

The New French Torpedo Boat Le Chevalier.

The new sea-going torpedo boat Le Chevalier, constructed by M. Normand, of Havre, has lately been tried with excellent results, and its rate of speed was higher than any hitherto attained in France. The boat has a length over all of 44 meters, and its beam at the water line is 4·38 meters, while its displacement is 118 tons. One of the principal modifications in the design of the boat is the placing of the rudder in front of the propeller, so as to avoid the necessity of extending the keel as a support for the rudder frame. The screws are placed in two transversal planes, and turn in the same direction. The machinery is composed of two triple-expansion engines, each one working a propeller, and they are supplied by two boilers upon the Du Temple system. M. Normand has profited by his own experiments, and the experiences of Messrs. Yarrow, in suppression of vibration, and this is done partly by equalizing the weight of the pistons. At the trials the engines developed 2,800 horse power without forced draught, and the consumption of coal did not exceed 900 grammes per horse power per hour. Under these conditions the speed attained was 27·22 knots. The famous boat, which ought to attain a speed of 30 knots, is still in its experimental stage, and M. Normand himself does not seem to be very sanguine as to its ultimate success.

AN IMPROVED BRICK PRESS.

The press shown in the illustration is a very powerful one, and is for pressing bricks from practically dry material. It has been patented by Messrs. Louis F. Gerding and Edward C. Harrison, of St. Joseph, Mo. The bottom of the mould consists of a plunger, which



GERDING & HARRISON'S BRICK PRESS.

raises the brick after it has been pressed into form, and into the top of the mould extends a pressing plunger which operates on the loose material delivered to the mould by a carrier, the latter also pushing the finished brick away from the mould, when the brick has been pushed up level with the surface of the table by the lower plunger. The pressing plunger is pivotally connected by a link with a lever fulcrumed at its middle on a transverse shaft, and the ends of this lever are pivotally connected by links with a lever pivotally connected with toggle levers, the latter being connected with a pitman formed at its rear end with a slot through which extends a cam shaft as shown in the small view. This shaft rotates at a comparatively low speed, and near each end is a cam engaging a friction roller in the rear end of a lever pivoted to the main frame, the front ends of the levers engaging a transverse shaft carrying the bottom plunger. The carrier which supplies the charge of loose material and pushes the formed brick away from the mould is reciprocated by means of rearwardly extending rods carrying friction rollers which engage cams on the outer faces of the large gear wheels. The strain during final compression, when the top and bottom plungers are in vertical alignment, as shown in the illustration, is taken up by boxes at the top and bottom.

"POLITE" formerly meant only polished. A scientific writer of a couple of centuries back speaks of "polite bodies like looking glasses."

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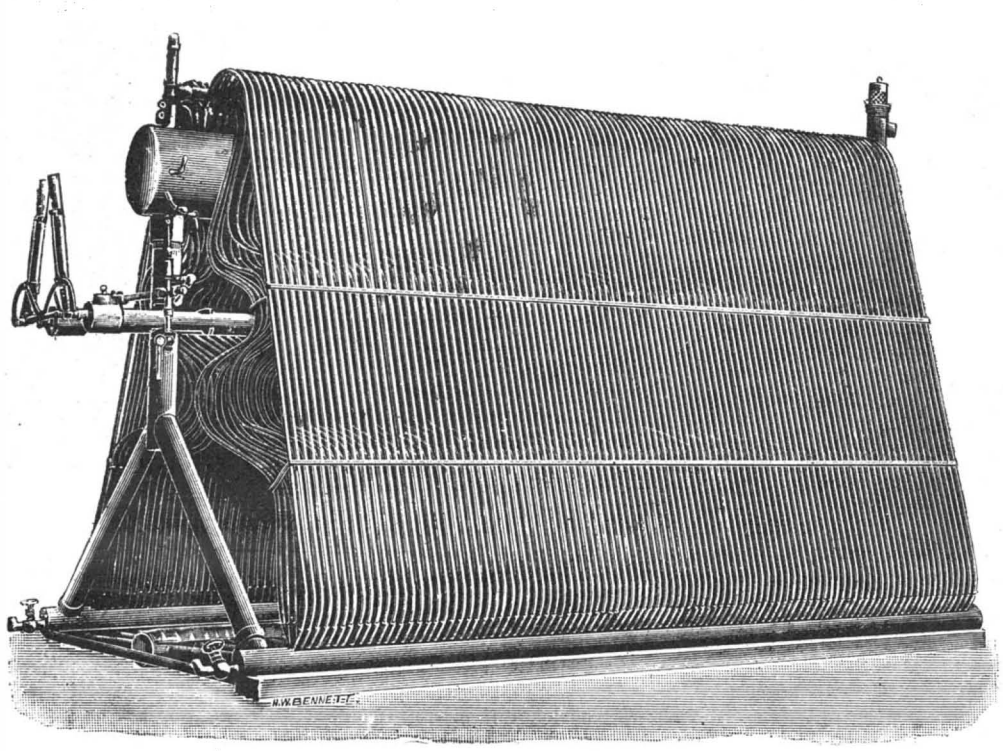
[FROM ENGINEERING, LONDON.]

TRIAL OF MAXIM'S STEAM FLYING MACHINE.

On Tuesday, July 31, for the first time in the history of the world, a flying machine actually left the ground, fully equipped with engines, boiler, fuel, water, and a crew of three persons. Its inventor, Mr. Hiram Maxim, had the proud consciousness of feeling that he had accomplished a feat which scores of able mechanics had stated to be impossible. Unfortunately, he had scarcely time to realize his triumph before fate, which so persistently dogs the footsteps of inventors, interposed to dash his hopes. The very precautions which had been adopted to prevent accidents proved fatal to the machine, and in a moment it lay stretched on the ground, like a wounded bird with torn plumage and broken wings. Its very success was the cause of its failure, for not only did it rise, but it tore itself out of the guides placed to limit its flight, and for one short moment it was free. But the wreck of the timber rails became entangled with the sails, and brought it down at once. The machine fell on to the soft sward, embedding its wheels deeply in the grass, and testifying, beyond contradiction, that it had fallen and not run to its position. If it had not been in actual flight, the small flanged wheels would have cut deep tracks in the yielding earth.

The Maxim flying machine is a large braced structure formed of steel tubes and wires, and is exceedingly stiff for its weight, which is about 8,000 lb., including men and stores. At its lower part it carries a deck, on which the crew stand, where, also, the boiler, steering wheel, and reservoirs of water and gasoline are mounted. At a height of some 10 feet above the deck come the engines, each of which drives a screw propeller of 17 feet 10 inches diameter and 16 feet pitch, working in air. Above the propellers is the great aeroplane. Smaller aeroplanes project out, like wings, at the sides, the extreme width being 125 feet and the length 104 feet. There are five pairs of wings, as shown in the illustration, but the intermediate three pairs are not always used, and at the time of the accident these were not in place. At that time the area of the aeroplanes was 4,000 square feet. With all the planes in position, the total area is 5,400 square feet. Forward and aft of the great plane are two steering planes, carried on trunnions at the sides, and connected by wire strands with a drum on the deck. By turning this drum the steering planes can be simultaneously tilted to direct the machine upward or downward, or to keep it on an even keel.

The chief interest centers on the boiler, as, unless this be made exceedingly light, it is hopeless to expect that the machine will soar. There is a very close resemblance between the Thornycroft boiler and Maxim's boiler. In each case there are two wing drums, connected by a large number of curved tubes with a steam and water drum, and there are also downcomers to facilitate the circulation. The casing is also made of straight tubes. In the boiler of the flying machine a feed heater is placed over the steam drum, but it is not shown in the engraving. The feed heater is constructed of steel tubes three-sixteenths inch bore and one-twelfth inch thick; the water is pumped through it at a pressure 30 lb. higher than the pressure in the boiler, and is delivered through an injector-like nozzle into the top of the downcomer pipe. The incoming water delivers its surplus energy to the surrounding liquid, creating a rapid and powerful current in the pipe, and consequently maintaining an active circulation in the small tubes in which the steam is generated. The feed pumps are placed on the deck beneath the engines, and are of variable stroke, so as to be adapted to the needs of the boiler. As they work at high speed, the valves are of large diameter—larger than that of the plungers. Pounding is prevented by a rubber bag on the suction and spring pistons on the discharge. The total quantity of water in the boiler only amounts to 200 lb., so that it is necessary that the amount of feed should be accurately adjusted. There is a very ingenious water level indicator. A small pipe is led in a loop from front to back and from back to front of the furnace. It is then taken to the steam and water drum, and led backward and forward through that in the same way, below the water line. The whole is filled with water, and forms a closed circuit having two loops—one in the furnace and one in the water. Now, so long as the upper loop is in the water the pressure does not rise greatly beyond that in the boiler, because the heat taken up in the furnace is conveyed, by the circulation, to the water in the drum. But if the water level falls in the drum, then there is no outlet for the heat; the pressure, consequently, rises most rapidly, and shows itself on a gauge attached to the pipe. By this most ingenious device an open-faced pressure gauge is substituted for the usual gauge glasses. The weight of the boiler, with casing, feed water heater, dome, and uptake, is 904 lb.; with burner and water it is 1,200 lb. The heating surface is about 800 square feet, and the flame surface 30 square feet.



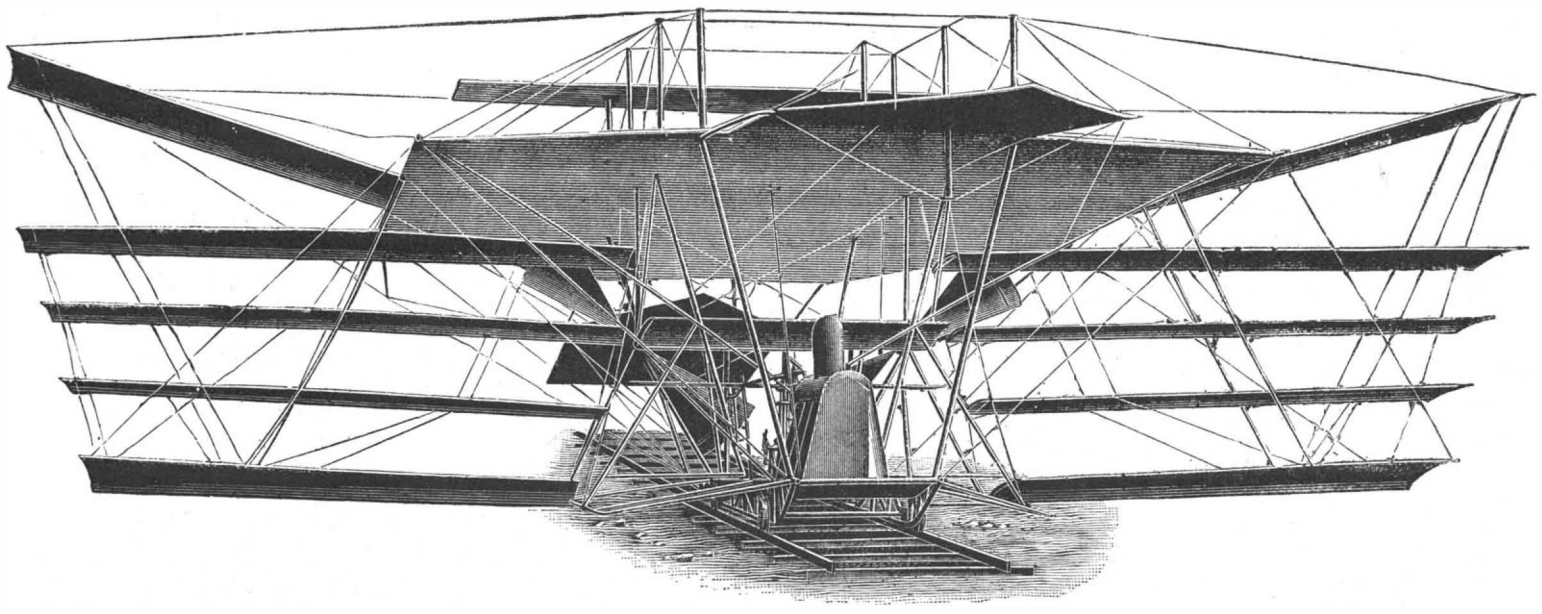
THE BOILER IN MAXIM'S FLYING MACHINE.

The fuel burned in the boiler is gasoline, of a specific gravity of 72° Baume. It is carried in a copper vessel on deck, and is pumped through a vaporizer into the furnace. The pipe from the pump is led into a vessel having a large gasoline burner beneath it. In this vessel the spirit attains a pressure of 50 lb. on the square inch, and a corresponding temperature, in which condition it is, of course, highly inflammable. The gas which it gives off is conducted by a pipe, passing through the furnace, to a jet, like that of a Bunsen burner, at the front of the furnace, and in rushing through it, induces a powerful draught of air, with which it mixes. The combined charge passes through hollow fire bars, pierced on the upper surfaces with fine holes, and burns in 7,650 separate flames. The arrangement is so powerful that the pressure in the boiler can be raised from 100 lb. to 200 lb. in a minute. The air supply can be regulated at will, while the expenditure of gasoline automatically adapts itself to the needs of the boiler. The pressure of the gasoline vapor acts on a lever, which is balanced by a spring. If the feed is greater than the consumption, the pressure on the lever puts a pawl in gear with a ratchet wheel, and, through intermediate mechanism, works a block along a slotted arm to reduce the throw of the gasoline feed pumps. If the feed is too small, the opposite effect is produced, and the throw of the pump increased.

There are two screws, each driven by a separate compound engine, having cylinders 5·05 inches and 8 inches in diameter by 12 inches stroke. The steam is distributed by means of piston valves having 3 inches stroke, and operated by eccentrics. The exhaust steam is delivered into the air, but Mr. Maxim informs us that he used successfully an air condenser. This seems to be a necessity, because the supply of water would prove a serious load. Even to drive 100 horse power would require some 2,500 lb. of water per hour, which would be a considerable addition to a lengthy trip, especially if undertaken for warlike purposes in a hostile country.

To supplement, or replace, the safety valve, by-passes are provided so as to allow live steam to pass directly to the low pressure cylinders. Instead of blowing off into the air, the steam is blown past the high pressure cylinders, and the fall in pressure is made to do work on the exhaust from the high pressure cylinders, drawing the steam from the high pressure cylinders and driving it into the low pressure cylinders. The boiler will make more steam than the engines can take in the usual way.

The boiler pressure, when running, is 320 lb. per square inch, giving in the high pressure cylinder a differential pressure of 195 lb. and in the low pressure cylinder 125 lb. The cut-offs are respectively 0·75 and 0·625 of the strokes. In the high pressure cylinder there is a very large clearance, designed to prevent injury from water in case the machine should pitch. The actual horse power delivered to the screws is 363 when the engines are running at 375 revolutions per minute. Of this, we are informed by Mr. Maxim, 150 horse power are expended in slip, 133 horse power in actual lift on the aeroplanes, and 80 horse power in driving the machine, with its frames and wires, through the air. The thrust of the screws, when the machine is moored, is 2,100 lb., and when it is running it is 2,000 lb. We give these figures as they were supplied to us, omitting decimals. The total lift is something over 10,000 lb. at a speed of forty miles an hour and with the aeroplanes making an angle of about 7·25 degrees with the horizontal.



THE MAXIM FLYING MACHINE.

AN authority on hypnotism says that hysterical persons are very difficult to influence. They are so wedded to their own fancies—mental and physical—that they prove very obstinate hypnotic patients. Even if an influence is gained, it passes off very quickly.

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The Antwerp Universal Exhibition.

[FROM A SPECIAL CORRESPONDENT OF THE SCIENTIFIC AMERICAN NOW AT ANTWERP.]

(Continued from page 147.)

Included within the coal department is the interesting exhibit of the Semet-Solvay process for the distillation of coke. There are photographs of the establishments at Couillet, Havre, Northwich, Ruhrort, and Fémalle, where the business is carried on, and specimens of the coke used at each place. Models of the stills set in brickwork are shown, and beside them are the jars of products, including sulphate of ammonia, naphthaline, benzol, and oils, heavy and light.

M. Solvay is a Belgian; so there is every reason for his taking a conspicuous place for the results of his process, which has so materially affected and benefited so many industrial arts. Such a place he has in the central hall. The principal wall of his fine room is covered with large pictures of his soda-producing works. A rectangular solid 2¼ inches long by ¾ of an inch thick represents the production between the years 1864–68; a solid 2 feet square and 2½ inches thick represents it from 1889–93. And the wide distribution of the factories shows how the invention has been utilized. The great establishments are at Syracuse, New York; Northwich, England; Donetz, Russia; Couillet, Belgium; Ebensee, Austria; Wyhlen, Sarralbe, and Roschnitz, Germany. A large table is covered with articles dependent upon soda for their manufacture: soap, porcelain, glass, wood pulp, and the paper made of it, etc. A bit of brick wall is given, because mortar for winter use should contain soda.

Not the least interesting part of this exhibit are the fossils found in the phosphate beds at Ciply, Belgium, and presented by M. M. Solvay & Company to the Royal Natural History Museum at Brussels. There is an almost perfect skeleton of a prognathosaurus and the cast of another not so nearly perfect; and besides these orthoceratites and other shells. A mass of the rock is shown with these shells, including ammonites, very numerous in it. Phosphates and superphosphates made in the works at Bernburg, Germany, from this rock, are shown in jars.

The brewers and wine makers of Belgium occupy a great deal of space. They show their grains, hops, bottles, demijohns, kegs, barrels, all sorts of apparatus for cooling the beer, filling and washing bottles, etc., everything, I believe, they illustrate except how to remedy the evil that is wrought by their product. It appears that the business is so profitable or praiseworthy that the Trappist monks in a convent near here have gone into brewing and are sending their beer to the Congo State. Some of the brothers have gone there as missionaries too. Whether they combine the introduction of their liquor and doctrines, I have not heard.

The Congo colony has a building devoted to its interests, with specimens of the native grass-covered huts on the grounds near it. A large relief model gives a good idea of the size and surface of the state. A case of books in the language suggests what has been done for the education of the people. A score or more of the natives were imported to give life to the Congo village, but the weather has been so cool all summer that some of the time the poor creatures have had to be kept over the military bake house. What an unpleasant idea of civilization that must give them! A small squad who have learned military tactics sometimes parade in heavy overcoats, with guns on their shoulders, to the great delight of the children on the grounds. They are small, good-looking men, with shiny faces. I noticed two or three at work setting type for a little printing press, under the direction of a man who spoke French to them with as much rapidity as he would use to a countryman of his own. A very successful attempt has been made to show what the commercial resources of the Congo State are. Quantities of gum copal, cotton, caoutchouc, extracted from the roots of plants, and elephants' tusks, both in the rough and cut into ornaments, are among the exports best calculated to excite the interest of merchants; on the other hand, the Belgian dealers have in the same building a great display of the exports which they send to the Congo. They consist chiefly of articles of dress and comfort for Europeans who go there. It would appear that a man needs a special outfit for life in Central Africa, which includes a sort of openwork shirts, shoes of the finest finish and supplied with an extra weight of nails, and suits of a white fabric elegant enough for the most fashionable watering place. The blankets, brandy and liquors he requires are all shown in a way to tempt a luxury-loving man to go the Congo for the sake of having them.

Antwerp has her special show on the grounds in the form of what they call "Old Antwerp;" it is an attempt to reproduce a market place, with the houses upon it as they were two or three centuries ago, and it is generally regarded as the best part of the exhibition. You enter it by crossing a drawbridge over a moat, and pass under a wooden portcullis into the little city. The men who guard the gates are in picturesque costumes of red cloth, with loose red velvet straps over legs and arms, and hats trimmed with red and white ostrich tips. The large, stiff white ruff is an important accessory to the dress. The houses appear to have the lower story or the whole built of red brick laid in white mortar. Paint upon a thin coat of plaster makes this good imitation. The upper parts of some houses are of unpainted wood. They are built with pointed gables and roof windows; are lighted with little windows made of tiny panes of glass, and are altogether quaint and pretty. They are open to visitors, and we wander in and out. Close to the gate is a little shop where men with soft, artistic-looking caps and puffs on their shoulders are planing walnut timber, working it into doors and window sashes, like those still found in the Plantin Museum and other old buildings.

Next door a little picture gallery has been brought together; the first room contains some old pictures by Flemish and other painters, for sale at prices high enough to insure their value. A large painting of the real old Antwerp, by Snayers, on the occasion of the entrance of a cardinal into the city, is very interesting. The broad moat and bastioned walls, the windmills, the cathedral, St. Jacques and other churches are given a better perspective than in reality, I believe, they could have offered on this dead level, but the picture is the gainer thereby; the foreground is brilliant with the red coats of the soldiery, mounted and afoot.

Beyond this gallery comes such a succession of eating and drinking places as to lead one to wonder if these were the only pursuits of the old Antwerpers. Some of them are worth looking at, with their sanded brick floors, wood ceilings, great garlands of bright flowers; their high old chimneyplace, with pewter mugs and plates on the mantel, and coarse blue or brown beer mugs hung on the wall behind what in these days would be called a bar. The maids who serve the beer and whatever else may be sold are very attractive looking in their white caps and bright gowns, fashioned like their grandmothers of two centuries ago. Some of the brouveries open into bricked gardens, where musicians are stationed to allure people on to the quaint benches or chairs to take another mug of beer.

If this is to be taken as a fair representation of old Antwerp, about every building had something in it to sell—except the smithy, the town house, and the church. One shop, got up to represent the home of a wealthy burgher, is very pretty. The chairs are covered with leather, and copied from some Rubens had; the doors are carved walnut, so are the handsome cabinets for the queer old china; the pictures are (some of them) on wood; the candlesticks are heavy, brass; the tapestry hung on the walls is worn, but rich. If you were not told that everything is for sale, the illusion would be perfect. Glass cutting, diamond polishing, and lace making are industries that you watch, every now and then attracted by some before unseen old costume, or the comments of the throngs of visitors who are peering into the old wells and putting their heads into low windows and trying closed doors.

"Old Antwerp has killed everything else," says the Yankee who has brought some thousands of pounds of calcite here from Dakota, and set it up in the form of a passageway and cave. He calls it the "Mammoth Crystal Cave," and the Europeans who have heard of Mammoth Cave, in Kentucky, think they are seeing a sort of fac-simile of one room of it. Even if the man tells them that the cave these crystals came from is in South Dakota (which I doubt if he does to any but Americans), they don't know the difference.

The crystals are stuck into plaster to form the roof and wired together in masses to form columns, a few stalagmites stuck up in one corner with two or three pails of water to form a lake. In the center of the room there are really beautiful specimens of minerals from the Rocky Mountains and a variety of things for sale at absurd prices.

"Old Antwerp" put its price of admittance down to 10 centimes. As this is far the best sideshow there is, the others could not keep their prices any higher, and so this Yankee, who made with his cave from $2,000 to $4,000 a day in Chicago, is just barely paying his expenses here. This is what he confided to me; but what he feels most keenly is, that when the King or the Lord Mayor of London comes to visit Old Antwerp they get up a dinner for him there, and while he is eating it they raise their price, because they know the crowd will come in, even if they have to pay 20 centimes, when there is a chance of seeing such a celebrity.

The man of the grotto has made a combination with one who has what he calls a gold mine, and according to his sign, shows the extraction of the metal from the ore. There is an entrance to this from the cave, as well as from the outside, so that people who go into either place are given an invitation to see the other for 10 centimes extra. Then they are told that a California tree is thrown in for nothing. For they have brought the lower part of the redwood which was such a stately center to the government building in Chicago, and have made a restaurant of it.

Doubtless, all this the German correspondent found amusing, and well he might.

But to return to the Belgian section in the building: The iron ore and castings, the steel plates and sheet iron of enormous size, indicate the large business done by the Phœnix factory at Chatelineau. Copper and brass wire, utensils and plates, are made in Moulins.

The sugar refineries have made their displays really beautiful by arranging them in cases containing colored crystals, which have formed on strings suspended across round vessels and on the sides of the vessels. There are also piles of these large black, white, pink and brown crystals, showing perfect and modified forms in a most instructive way. The guns, rifles and cartridges are displayed in such quantity and variety as to indicate that Belgium is ready to make a brave and long fight for her autonomy, or to supply other nations in their warfare.

The piano and other musical instrument manufacturers have not been afraid to bring their products into competition with German and French makers, who have sent a great many examples of their work.

The inlaid floors, rich embossed leather for wall and furniture covering, the beautiful tapestries, the quaint and tasteful furniture, all of which are exhibited by different firms, chiefly in Brussels and Antwerp, are abundant evidence of skill in interior decoration.

The mineral waters, notably those from Spa, occupy large space; so do the cases of canned fruit and the national gingerbread so full of plums and citron and other good things as to make the little Johnny Horners very uncomfortable.

A very interesting corner is that occupied by the Messrs. Laloux, of Liege, with an exhibit of sponges, which they import from the Mediterranean and the West Indies. They are festooned on the wall, piled in sacks, and arranged in cases. It would seem as if men had been searching the depths with the old-fashioned five-pronged tridents, and in the divers' suits as well, to bring together as many curious sponges as possible. Many are still attached to masses of coral upon which they grew; and the coral is of various species. The brain and honeycomb ones are of special beauty. A few of the sponges are scarcely less than three feet long, and there is a round, hollow one that has about that diameter. Some are covered with long points; no less than thirty kinds are found along the coast of Tunis, and are called Sicilian sponges. A pile of black ones is in one of the cases; they are in the condition they were when taken from the water, the black viscous matter forming the vital part of the animal still remaining in them.

The effect of washing is illustrated by sponges in different stages of the cleaning process. The statement is made on one of the explanatory cards that sponges are found attached to rocks, algae, madrepores, shells, anchors, pieces of wood, submerged walls or any other rough surface in waters of suitable temperature. They are chiefly taken at the present day by men in diving suits; one of these forms a point of the exhibit with the pump used to supply him with air. I found the great copper helmet with its heavy glass eyepieces was all I could lift.

Belgium occupies 30,000 square yards in the exhibition buildings, my guide book says: it seems more than that to me. At any rate, she has well demonstrated her right to be and her ability to compete in the industrial world with the great powers. A. D.

Tungsten for Bullets.

The reduction of the caliber of guns is necessarily accompanied with a diminution in the weight of the projectile. The length of the latter, in fact, cannot exceed a certain limit, beyond which it would no longer have sufficient stability in its trajectory. It would therefore be of considerable interest to have at our disposal, for the manufacture of rifle balls, a metal of reasonable price and heavier than lead. One of the metals upon which hopes may be founded, remarks the Revue d'Armes Portatives et de Tir, is tungsten. This metal, which is almost as hard as steel, has a density varying from 17 to 19·3, say 1½ times that of lead. By reason of such qualities, balls of tungsten, of equal dimensions, possess a power of penetration much greater than that of lead. Thus, a tungsten ball penetrates a steel plate 3 inches in thickness at a distance of 650 yards, while a similar one of lead penetrates a 2¾ inch plate at 325 yards only. The present obstacle to the use of tungsten is its relatively high price; but there are indications that this will soon be lowered to reasonable figures.

Thumb Detection.

In course of transit between New York and New Orleans a packet of paper money had been opened and its contents considerably reduced. Two of the seals had been broken and one had been resealed by thumb pressure. Mr. Carvalho, an expert in matters of identification, endeavored to find out the thief, and with this view obtained wax impressions of the thumbs of all the officials of the American Express Company through whose hands the packet was known to have passed. The impressions were photographed and enlarged, and one of them clearly agreed with an enlarged photograph of the thumb-impressed seal. The thief was thus detected.

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Correspondence.

Slow Beating Pendulums.

To the Editor of the SCIENTIFIC AMERICAN:

In my article on "Slow Beating Pendulums" I did not give the lengths of pendulums used. I will state that in the first two experiments given each of the four pendulums were about 3 feet long (each pair being the same length). In the third experiment the long pendulum was 4 feet long and the short upright pendulum a little over half its length. I think I could have made them shorter and made them go as slow (or slower) if I had taken more pains in making pivots frictionless. I should have stated, also, that the lower or standing pendulums in each of these experiments were made wider at their lower ends, and resting on two points to prevent them from falling sidewise, as they would do if resting on a single point.

CLIFTON R. SUMMERS.

The Larix Europœa.

To the Editor of the SCIENTIFIC AMERICAN:

In your issue 25th inst, Mr. John L. Moore, of Quincy, Ill., inquires about the desirability of the wood of Larix europœa for fence posts. There could not by any possibility a worse wood be found than that of the "latsche"* for the purpose intended, it being even inferior to alder or cotton when subject to atmospheric influences, and this so much the more if the material is taken from young trees, or such as have grown in warm, low, or damp situations, where vegetation is overstrained. The tree is a mountain product, and its value is for indoor application, on account of its tensile strength and its notable freedom from the attacks of insects. The best fence timber of which I have any knowledge is the Nandubay algarroba of the River Plate, the wood out of which our best mallets and ten-pin balls are made. In the Banda Oriental are to-day corral fences dating from the Spanish Conquista, which promise to hold out again as long; and I have often wondered why this splendid wood, which is sure to grow throughout our own cotton belt, has so long been neglected by the Argus eyes of the Agricultural Department and the farmers. It grows rather slow and never in straight lengths, but for the wheelwright and fence maker in satisfactory segments. Speaking of fence construction, durable, economical of space and outlay, and generally more in keeping with our modern ideas, I have before the eyes of my mind a post constructed of cast iron or steel, hermetically embedded in a foot of some cheap glass, such as manufactured out of disintegrated granite for railway ties. Such a fence would outlast a dozen primitive contrivances of the present make, would occupy next to no room at all, and in its application as posts for the vintner would at once solve the vexatious riddle wherefrom to obtain in future the necessary paling for the vines. It would be tidy and conduce to tidiness.

ADOLF E. BOCKING.

San Antonio, Tex., August 26, 1894.

[POPULAR ASTRONOMY.]

Planet Notes for September and October.

H. C. WILSON.

Mercury will be at superior conjunction September 2 and will be in poor position for observation during the two months. He will be in conjunction with Saturn September 30 and with Uranus October 14. He will be at greatest eastern elongation, 24° 31′ E. from the sun, on the morning of October 19. In the evening about this time Mercury, to northern observers, will set only a half hour after the sun, so that it can be seen only in bright twilight. In the southern hemisphere the conditions for observation will be better.

Venus will remain "morning star" during these months, steadily approaching the sun and growing fainter. She will be in conjunction with the moon September 27 and October 27. On October 9, at 10 h. 56 m. A. M., Venus will be just 7′ north of the star η Virginis, and on October 29, at 10 h. 7 m. A. M., she will be 1° 6′ south of Saturn. Both, however, will be too close to the sun to be easily seen.

Mars during these months will be in excellent position for observation. He will be in opposition October 20. His distance from the earth will then be about 40,500,000 miles, or about 5,000,000 miles greater than it was at the opposition of 1892. His declination, however, is 33° further north, so that for northern observers the planet is in very much better position than in 1892. Professor Pickering has already reported interesting observations of the surface markings of the planet, made at the new Lowell Observatory at Flagstaff, Arizona, and it is not too much to expect that more and better observations will be obtained this year than ever before. Mars is now in the constellation Pisces, moving eastward. September 15 he will turn the loop in his apparent course and begin retrograde (westward) motion, remaining in Aries and the corner of Pisces during the two months. The reader will easily recognize Mars by the ruddy color and great brilliancy, this being the brightest object in the south-eastern sky. Mars will be 7° south of the moon September 18, at 10 h. 49 m. A. M., and 5° 31′ south of the same on October 15, at 6 h. 31 m. A. M.

Jupiter is the brilliant star one sees rising a little to the north of east soon after midnight. In October Jupiter will be in position to be observed a little before midnight. He will be at quadrature, 90° east from the sun, September 28; at conjunction with the moon September 22, at 3 h. 9 m., and October 19, 11 h. 5 m. P. M. Jupiter is in the feet of Gemini, moving eastward, but will begin retrograde movement October 24.

Saturn and Uranus will not be in position for observation, Saturn reaching conjunction with the sun October 21 and Uranus November 7.

Neptune may be observed after midnight. He is in Taurus, quite near the sixth magnitude star l Tauri.

* Latsche is the name of the tree in the German-Swiss Alps, where it grows to its greatest perfection. When ripe, i. e., not less than 100 years old, it is highly prized for joists and rafters, and in the Berner Oberland are chalets built three times over out of the same material.

Rock Zymosis.

BY W. R. MACDERMOTT, M.B. T.C.D.

The other day I went into a quarry of Silurian slate, in the County Armagh, Ireland, with my bag and hammer. After spending an hour on my investigations, I went over to the only occupant of the place besides myself, a one-eyed man sitting on a heap of stones breaking the rock for a road contractor. "Are there any other quarries about here, my friend?" I asked him. "Why? Who do you want to break for?" was the answer. "Well," I said, "I suppose I might as well break for some one as be at what I am at." "'Deed, an' I daresay," the man remarked, half contemptuously, wholly emphatically. He had been eyeing my proceedings very curiously, and came to the conclusion that I was some half-witted creature with no honest calling like stone breaking in life.

I give this anecdote because I fear the professed geologist, like the stone breaker, will take me as in want of a vocation. Are you a glacialist? Are you an anti-glacialist? Pooh, pooh! poor creature, you are nothing at all. The professed geologist is nothing if not a theorist, and not being a theorist, I may fail to be recognized as a geologist.

I will stick to my facts, nevertheless. Here is one. In this region of Lower Silurian slate rock, half, or at least some large proportion, of the surface strata is in some stage or other of decay. Often it is not easy to get a bit of sound unchanged slate. Now, this is a great big fact, considering that it must have been going on through geologic time heaping up results from age to age—a wider, larger fact far than ice action; but while the last has a literature to itself, the first has not even been described in simple terms of observation. The book geologist works per contract for the glacial theorist; if with two eyes, yet with but one idea.

Thus the great twin facts of rock integration and rock disintegration as they occur before our eyes or may be followed out with the aid of the microscope, have scarcely been described as they really occur in the full field of observation. In this field there are three classes of causes, mechanical, chemical and vital, to which these facts are referable in the case of the sedimentary rocks. With respect to rock integration or building, mechanical and chemical action is very ill understood, while direct vital action, except as to the corals, is quite ignored. Yet many rocks, slate among them, show under the microscope evidence of structure which can be more easily set down as organic rather than as inorganic, and we may reasonably suppose that the micro-organisms which swarm in sea and fresh water muds have effect in determining the ultimate form of the material they inhabit.

On this point I could say much, but my subject here is the opposite problem of disintegration. In this the main agent must be vital though, of course, non-living physical actions co-operate. We have in the case of the stone rot which affects buildings an example of what occurs on the great scale in nature and which makes the question an immediately practical one. This stone rot shows many curious peculiarities, but it is evidently contagious, spreading from foci and due to the action of micro-organisms in the stone. In nature the contagium can be easily traced, as it can be also experimentally. I have boiled pieces of sound Lower Silurian slate in strong mineral acids and in solutions of the caustic alkalies and of the alums with little or no effect. The same graptolithic slate yields, though slowly, signs of the characteristic disintegration in presence of "rotten slate" or water in which it has been digested. The chemical products characteristic of the decomposition in slate are invariably alums, generally iron alums, from the presence of pyrites in the stone. The insoluble residue is composed of pure alumina with some granular quartz and graphite.

The Lower Silurian slate districts of the counties of Armagh and Down which I have examined are seamed with canyons, which though small are on a scale often as great as those of the Colorado. A little rill often running only in the course of rains is found almost lost in a relatively vast excavation. This tiny stream could never have worn away solid rock to such an extent; its mechanical power is really so small that it is often choked by earth banks. But the solid rock is not there. Bosses and walls of hard grit often indeed are exposed here and there, but for the most part the walls of the canyon are made of rotten rock or its evident debris. The initial action in the formation of the chasm was rock decay; the stream only carries away the products of that decay fitfully and imperfectly—so imperfectly that sometimes we have only a gully in clay banks; the decaying mass overmasters and swallows up the little stream. But that decay is easily seen to be specific in nature. Sound Silurian slate is one of the toughest of rocks; it is quite as well able to resist the mechanical action of water as the grit. In these little canyons, however, we find it dissected away from the grit in virtue of a specific decay of which the latter rock is insusceptible. This it is that gives the canyon its characteristic broken outline, both as to sides and floor. The rill wears away neither the slate nor the grit, it only washes away the products of decay of the former, leaving the latter untouched, not because of its hardness, but because of its insusceptibility to the slate zymosis.

In hundreds of directions I have observed this dissecting away of specifically zymosed from unaffected rock. It does not follow that the rocks separated are always generically distinct. Some kinds of slate resist zymosis better than others; the action in the same bed of slate is obviously unequal. Often we follow in the same strata from point to point the several stages of decay. Part of the strata preserves its original laminated structure, a little farther on the rock becomes a mass of angular dovetailed fragments, in fact a contorted rudimentary conglomerate; in another place again we find virtually clay interspersed with pebbles and fragments which for one reason or another have been able to resist the specific action. Much of what is called in books bowlder-clay drift, conglomerate, and so on, I believe is simply rock decomposed in situ, and altered only by percolation, slipping and settling.

The key to the problem is this specific nature of the zymosis; it is this which gives us the physical facts. Slate, sandstone, granite and other rocks have each their specific form of decay; it is not a process extending through rocks in contact indifferently. I have found a bed of slate lying between grit in a state of decomposition, soft and evidently thinned out, the grit above and below being quite sound. The superincumbent bed in this case would be tilted uncomformably on the lower as the intervening layer would disappear, and if it slipped the pebble debris of the decomposed layer would groove and striate both surfaces of the grit. Thus an intervening rock bed might disappear wholly or in part between two beds of unlike rock, leaving a thin layer of pebble or sand to represent it. Again, a slate rock may be so zymosed in situ as to leave a pebble layer, which has all the appearance of drift. Examining carefully exposed quarry faces, we often find a continuous action evident, whereby the superjacent clay must be taken as the underlying rock zymosed in situ. But this clay constantly is indistinguishable from what is usually called bowlder clay.

I write here in the hope that the attention of open-minded American geologists may be directed to the point in their own country. In Europe the geologist, as a rule, has to be cured of ice action on the brain to recover the faculty of sane observation.

Poyntz Pass, Newry, Ireland, August 20, 1894.

Boilers for River Steamers.

A law recently passed provides that no river steamer shall have an externally fired boiler with shell plates of iron or steel exceeding an average thickness of 30 100 of an inch. No boiler of this type on such vessels shall have less than 3 inches space between its shell and any of its internal flues, and not less than 3 inches space between such flues when any such flues are more than 5 inches in diameter; and every such externally fired boiler employed on any such steam vessel shall be provided with a manhole, in the lower part of the front head thereof, of such dimensions as may be prescribed by the Board of Supervising Inspectors, in all cases where the distance between its internal flues is less than 3 inches. Externally fired boilers having shells constructed of iron or steel plates not exceeding an average thickness of 0·50 inch may, in the discretion of the Secretary of the Treasury, be authorized and employed on steam vessels navigating the Atlantic and Pacific Oceans, or salt water bays or sounds, or the great lakes, or any of them, and water flowing to and from the same, or any of them; provided that in inspection, no plate that is by this act limited to a thickness of 0·30 inch, and no plate that is by this act limited to a thickness of 0·50 inch, shall be rejected for use if found to exceed these dimensions respectively, if the average thickness thereof does not exceed the limits therein specified; and the amount of steam pressure that will be permitted to be carried in boilers constructed in accordance with the requirements of this of the act shall be determined from measurement showing the least thickness of the plates.

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Cold-storage Rats and Cats.

The Pittsburg Dispatch says that in the cold-storage warehouses in that city there were no rats or mice. The temperature in the cold rooms was too low. The keepers soon found, however, that the rat is an animal of remarkable adaptability. After some of these houses had been in operation for a few months, the attendants found that rats were at work in the rooms where the temperature was constantly kept below the freezing point. They were found to be clothed in wonderfully long and thick fur, even their tapering, snake-like tails being covered by a thick growth of hair. Rats whose coats have adapted themselves to the conditions under which they live have domesticated themselves in all the storage warehouses in Pittsburg. The prevalence of rats in these places led to the introduction of cats. Now, it is well known that pussy is a lover of warmth and comfort. Cats, too, have a great adaptability to conditions. When cats were turned loose in the cold rooms they pined and died because of the excessive cold.

One cat was finally introduced into the rooms of the Pennsylvania Storage Company which was able to withstand the low temperature. She was a cat of unusually thick fur, and she thrived and grew fat in quarters where the temperature was below 30 degrees. By careful nursing a brood of seven kittens was developed in this warehouse into sturdy, thick-furred cats that love an Icelandic clime. They have been distributed among the other cold-storage houses of Pittsburg, and have created a peculiar breed of cats, adapted to the conditions under which they must exist to find their prey. These cats are short-tailed, chubby pussies, with hair as thick and full of under fur as the wildcats of the Canadian woods. One of the remarkable things about them is the development of their "feelers." These long, stiff hairs that protrude from a cat's nose and eyebrows are, in the ordinary domestic feline, about three inches long. In the cats cultivated in the cold warehouses the "feelers" grow to a length of five and six inches. This is probably because the light is dim in these places, and all movements must be the result of the feeling sense. The storage people say that if one of these furry cats is taken into the open air, particularly during this hot spell, it will die in a few hours. It cannot endure a high temperature, and an introduction to a stove would send it into a fit.

THE NEW UNITED STATES CRUISER CINCINNATI.

The cruiser Cincinnati, built at the Brooklyn Navy Yard, returned on September 8 from a two weeks' trial trip, during which her crew was exercised in various details of the service drill, and the machinery was subjected to a most thorough inspection. The engines, as well as the hull of the vessel, were constructed complete by the government, with the exception of the armor plates, and there has been no speed trial to determine the rate she might make over a measured course, although the tests to which she has been subjected indicate plainly that her speed on such a trial would be materially over nineteen knots an hour, for which her engine power was calculated.

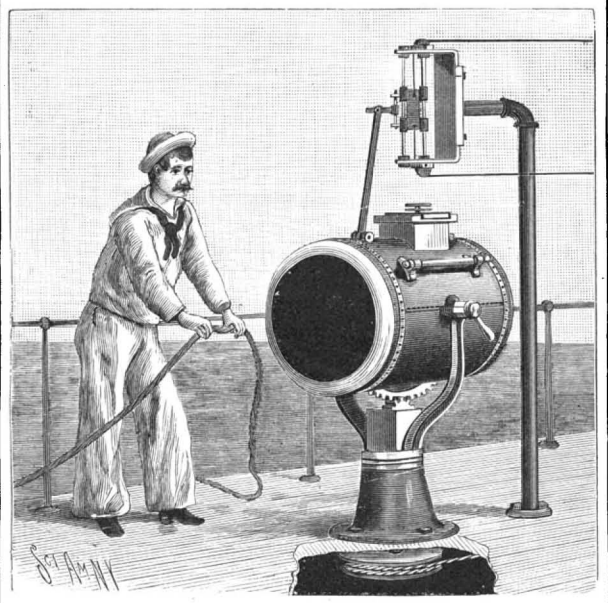
The Cincinnati is a protected cruiser of 3,180 tons displacement, 305 feet long, 42 feet beam, and with a mean draught of 18 feet. She has twin screws and two vertical triple expansion four-cylinder engines. The diameters of the cylinders are 36, 53, 57 and 57 inches, and the length of stroke is 33 inches. Steam is furnished by four double-ended and two single-ended boilers, and the engines are designed to develop 10,000 horse power.

The armament of the Cincinnati comprises a 6-inch breech-loading rifle mounted on central pivot carriage on topgallant forecastle, and one 4-inch rapid fire gun on each side of poop, with four 4-inch rapid-fire guns in each broadside, and six torpedo tubes, with an auxiliary battery of one pounder and six pounder rapid-fire guns.

The inspectors of the hull and machinery are said to have been thoroughly satisfied with all of the work put into the Cincinnati, and the department has received many congratulations on the success of the first ship of the new navy designed and built throughout by the government.

A SEARCH LIGHT RANGE FINDER.

The illustration represents a construction designed for use on shipboard, to enable the pilot to operate the search light to throw the rays of light in any desired direction. The improvement has been patented by Messrs. Patsey J. Daugherty and William F. Litten, of Bellaire, Ohio. The light is journaled in



DAUGHERTY AND LITTEN'S TILTING DEVICE FOR SEARCH LIGHTS.

brackets, to permit of tilting it up and down, and the brackets turn in a suitable bearing, being on a central shaft having a pulley over which passes a rope leading to the pilot house. The front end of the search light is connected by a link and arm with a slide moving vertically on rods or guideways of a frame supported from a standard in position above the light, and the slide is connected at its top and bottom with a rope which also extends to the pilot house. By pulling in one direction or the other on this rope the slide is moved up or down, and the front end of the search light is correspondingly inclined, while by pulling on the other rope the central shaft is turned and the light swung from one side to the other.

Prevention of Suffocation in Mines.

As the result of elaborate investigation, Dr. J. S. Haldane arrived at the conclusion that in colliery explosions the deaths from suffocation were due, not, as was generally supposed, to carbonic acid gas, but to the preponderance of nitrogen and the deficiency of oxygen. Life could be saved if the colliers could be supplied with oxygen for an hour or so; and he had devised and exhibited an apparatus for enabling a man to breathe oxygen, of which 60 liters were compressed into a one-half liter bottle, with tube and regulating taps, supplemented by a wire compress for the nose to prevent breathing through that organ.

[FROM THE NEW YORK SUN.]

Dynamite's Entry on the Field of War.

The tests of the dynamite gun at Sandy Hook recently established a new principle in regard to the defense of our coast, namely, that hostile war ships cannot enter the harbor of New York. Striking and one-sided as that proposition may seem, it cannot be called extravagant after the evidence of the three shots fired from the pneumatic gun. Against a quarter of a ton of dynamite, placed and exploded with reasonable accuracy, any vessel, armored as heavily as they like, becomes like newspaper; it cannot stay afloat. No ship would even dream of approaching the coast where dynamite guns of proved efficiency are known to exist. They might as well sail straight over Niagara.

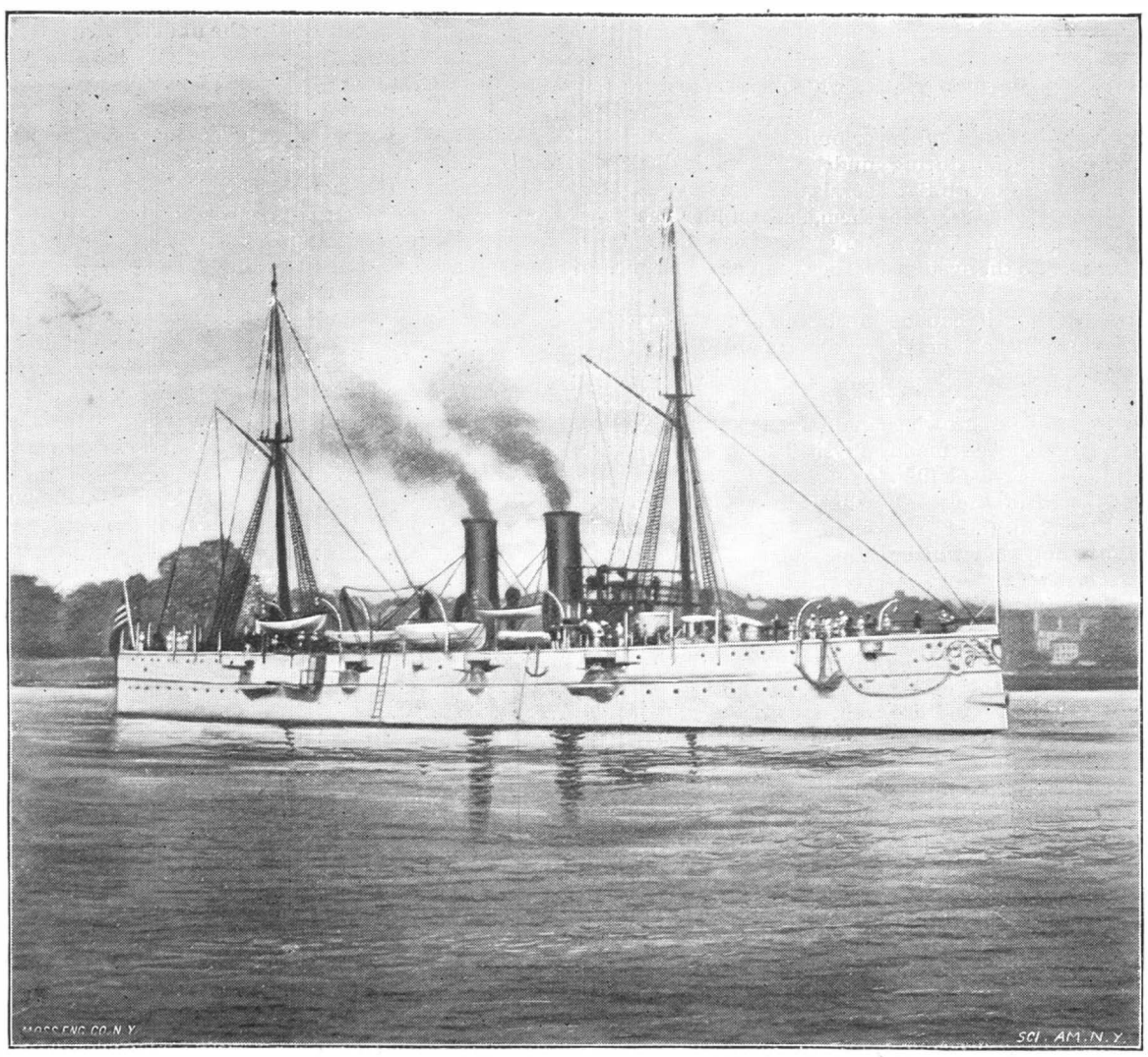
The power of shooting a great mass of high explosive wipes the old limitations of artillery out of existence, inasmuch as the great area of destructiveness covered by the explosion of 500 pounds of dynamite makes the extreme precision of an ordinary gunshot no longer indispensable. The mark aimed at will be struck if the projectile itself falls within a hundred yards of it. The historical sure-pop shot at the broadside of a barn has been reversed by a system by which the barn itself is shot through the air as a projectile, destined to crush everything that its broad mass may fall upon. Dynamite guns in their last possible perfection may still remain very liable to get out of order; but a mere reasonable possibility that they will work must create a terrorism against all craft approaching for hostile purposes sufficient to make the coast practically unapproachable.

Pneumatic guns have been taken off our dynamite cruiser Vesuvius for the reason, we believe, that practice at sea has been found too inaccurate to be valuable. However that may be, the advantage which a gun of this sort on land will have over one set upon the water is pretty sure to be sufficient to make the water gunner conclude to avoid the fight.

After this great and memorable step toward the final abolition of all war generally, New Yorkers may sleep soundly o' nights.

The Petrified Forests of Arizona.

In one of the meetings of the American Forestry Association held in Brooklyn lately Dr. Horace C. Hovey, of Newburyport, Massachusetts, showed by specimens and by views the petrified forests of Arizona. This great tract of agatized wood, at least 2,000 acres extent, is near the station, of Corrizo and Adamannas on the Atlantic and Pacific Railroad, in Arizona, and resembles an immense logging camp with huge trunks thrown about. The largest are ten feet in diameter, many of them severed as evenly as though cut up by a cross-cut saw, and the sections vary from disks like cartwheels to logs thirty and more feet long. Many of the petrified logs have been broken into glittering fragments by action of the weather and by Indians and tourists, and at every footfall the traveler steps upon a mosaic of carnelian, agate, jasper, topaz, onyx and amethyst. A petrified trunk 150 feet long spans a canon, and is known as the Agate Bridge. The name Chalcedony Park has been given to the tract. Curiosity hunters, manufacturers and speculators are rapidly destroying its beauties, and recently a company proceeded to pulverize the chips and logs, the powder to be used in place of emery. Car loads of the petrified wood are being shipped away for this use, and Dr. Hovey advocates the saving and protection of these dead forests in a public reservation by the government.



THE NEW AMERICAN WAR SHIP CINCINNATI.

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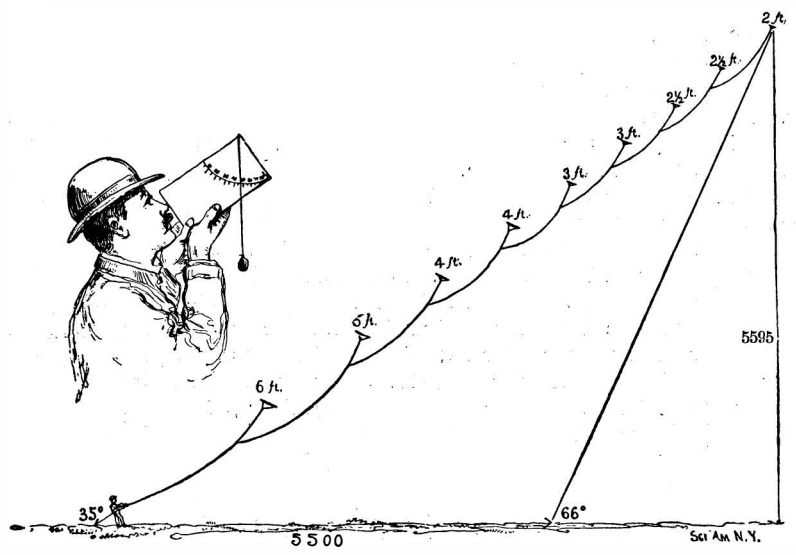
THE EDDY MALAY TAILLESS KITE.

More accurate weather prediction will probably result from a better knowledge of the upper air currents. At the suggestion of Professor S. P. Langley, Secretary of the Smithsonian Institution, at Washington, I began in April, 1894, to experiment with silk cord, with a view of reaching an altitude of 10,000 feet. Professor Thurston shows that silk has great strength and lightness. The first question to be determined is the supporting power of the air at a height of two miles. Will rarefied air support a series of tandem kites? The researches at Blue Hill Observatory, Mass., under the direction of Mr. A. Lawrence Rotch, have led to the astonishing discovery by Mr. H. H. Clayton, whose discoveries in weather periodicity are widely known, that the average wind velocity at a height of five miles as denoted by the movements of clouds is about one hundred miles an hour for the year. These cloud velocities are not guessed at, but are measured with extreme care at Blue Hill Observatory by means of the sky reflected in the measured surface of mirrors. There are therefore indications of a steady wind at great heights to offset the possible want of support due to attenuated rarefied air. The four principal ways of reaching the upper currents are by balloons, flying motors, projectiles, and kites. Balloons have the disadvantage that if held captive they are driven down sideways by the wind, and if released they float with and are surrounded by the same air, and so fail to record progressive changes above a local point. Flying motors would serve well if they could maintain their place aloft without great expense. Projectiles, if repeatedly discharged, would be very costly and would probably necessitate the use of an arm of the sea or a desert where people would not be injured by their descent. To uncoil a line launched upward into space with the velocity of a cannon ball would be decidedly difficult, even if the self-recording instrument were not torn to pieces while rising or descending.

There are several obstacles to the use of kites which I found it necessary to overcome. First, the instability of the hexagon kite with a tail. It is an ordinary characteristic of the wind to increase from a calm to twenty miles an hour in two hours. These variations cause the tail kite to dive and become totally unmanageable, as every schoolboy knows. Professor C. F. Marvin, of the Weather Bureau, found by experiments that gusts may suddenly increase the pressure upon a flat disk thirty-five per cent. This formidable phase of kite flying has probably delayed the use of the kite for scientific purposes for nearly a century. Mr. E. Douglas Archibald, of the Royal Meteorological Society, revived the scientific use of the kite in 1884, and contributed an account of his experiments to Nature in 1886. By means of two kites, diamond shaped, respectively four and seven feet in diameter, covered with Tussore silk, he achieved an altitude of 2,200 feet, and carried up anemometers registering the wind velocity at various heights on the kite string. The kites flown by Archibald were placed one above another on the same string, but the upper one was probably attached to the back of the lower, because he speaks of the movement of the lower kite being injured in its freedom of movement by the pull of the upper, a result which I verified by experiment at Bergen Point, N. J., in 1891.

In the summer of 1890, while experimenting with hexagon tail kites at Bergen Point, I found that the best tandem system was not to fasten one kite to the back of another, but to give each kite its individual string and allow it to branch upward from a main line. This method was so successful that on May 9, 1891, at Bergen Point, with a ten or twelve mile wind from the west, and with five hexagon tail kites to lift the main line, the top kite became a very distant speck, estimated at 4,000 feet high by those looking on, although no triangulation of the altitude was made. I have since become convinced that the probable altitude was 6,000 feet, but as it was not measured, I have not so far included it in my records of altitudes.

The hexagon tail kites carry up a wonderfully steep string, but they call for long individual lines to each kite to prevent the kite tail from becoming entangled with the line below. Very high altitudes and valuable meteorological records can be made with them, but the Malay tailless kites excel them. I have Malay tailless kites that fly with a steeper string than the hexagon, and require no hauling down if the wind increases from eight to thirty-five miles an hour—conditions which would bring to the ground a tail kite. Sometimes the wind is light at the earth and very heavy aloft. The tail kite will then have too much weight for the lower current, and too little for the upper, which quickly whirls it to the ground. In 1891, under these exceptionally unfavorable conditions, I spent hours of fruitless effort upon different weights of kite tail. All this trouble disappears with the use of the Malay kite, especially the inability to make an ascension in light winds. Since the Malay kite has only two light sticks and can be built of very light paper as well as cloth, it is at home in mild winds of from four to eight miles an hour. Especially thin kites, without even the weight of cord at the edges, will rise to a great height in a dead calm, if the person holding the line walks at the rate of about three miles an hour. The cloth-covered kites are much heavier, for use in strong winds.



METHOD OF TRIANGULATION FOR MEASURING ALTITUDE.

The experiments at Blue Hill Observatory, ten miles south of Boston, began on July 27 and ended on August 6, 1894. I carried to the Observatory, which is at the summit of Blue Hill, 640 feet above sea level, fifteen tissue paper kites, to be flown with silk thread belonging to the Smithsonian Institution. My object was to reach an altitude of 5,000 feet with the top kite at Blue Hill, with small tissue paper kites, and then to place these light kites above a heavy tandem line at Bergen Point, N. J., which had already a record of 5,595 feet on November 7, 1893. The two tandem lines, one above another, ought to reach a height of two miles, with not over twenty kites. But I found the construction of small kites far more difficult than large ones, and that in ten days it would be impossible to perfect the apparatus.

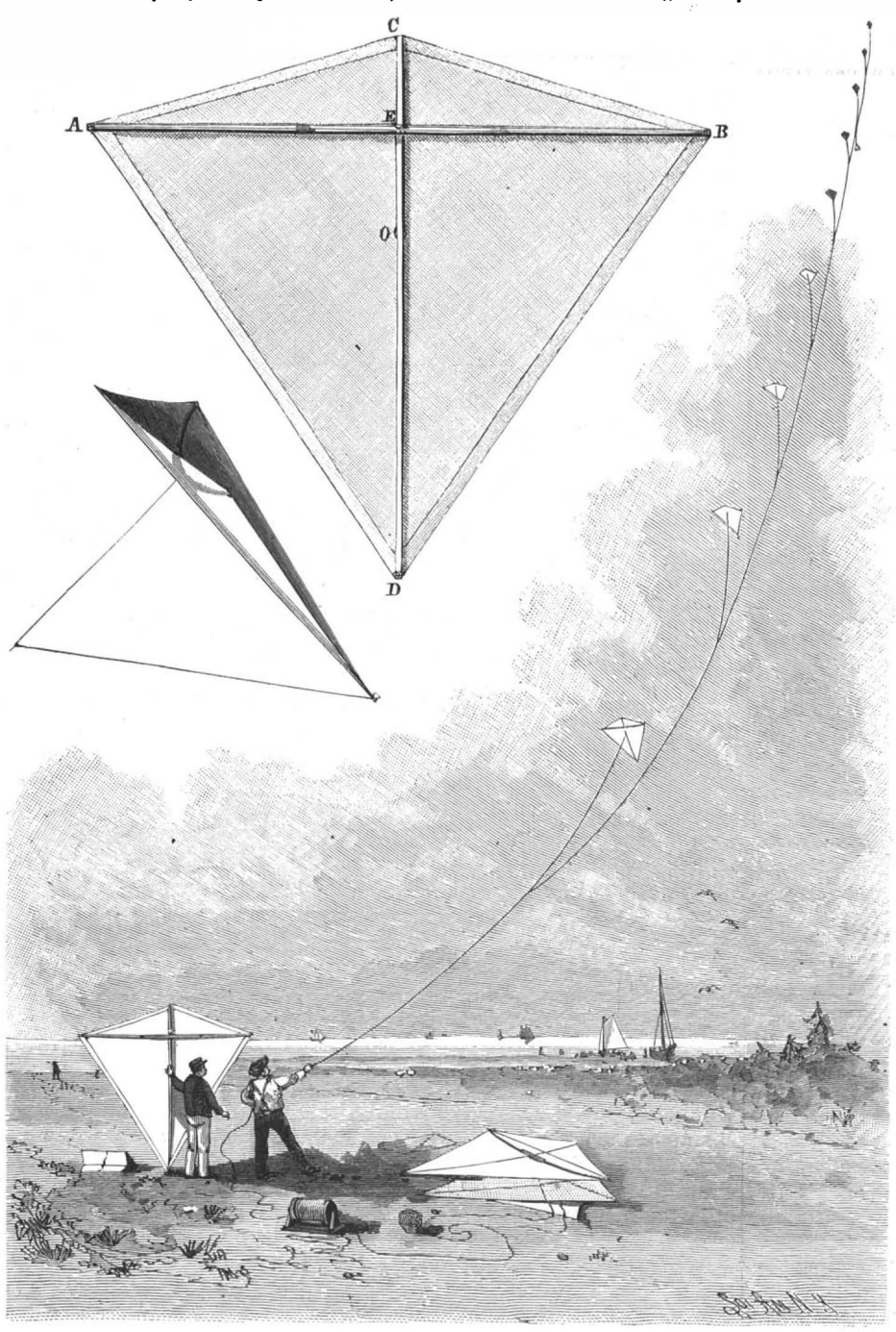
The highest altitude was made by the topmost of seven kites, on August 1, when a height was triangulated of 3,540 feet above the hill, or 4,180 feet above sea level.

On August 4 the highest point reached with a thermograph, made by Richard Brothers, Paris, remodeled and lightened by the use of aluminum, by Mr. S. P. Fergusson, of the Observatory, was 2,040 feet above sea level, or 1,400 feet above the hill.

It brought down a record of 6° colder than at the earth's surface. The instrument was supported at the intersection of three tandem Malay kites, one seven and two four feet in diameter, and was projected upward with the lifting power on the main kite line below of one nine foot and two six foot kites. So far as the writer knows, the nine foot kite, made by Willard Fergusson, was the largest Malay kite ever built. The total maximum pull for the six kites was 48 pounds, by spring balance, and the minimum was 30 pounds. Since the thermograph weighed 2 pounds, and the least pull at a height of 1,400 feet was 30, it seems to follow that in a wind of 20 miles an hour a man, weighing 150 pounds, at a height of 1,400 feet, on a kite string, would cause a pull at the earth of 2,250 pounds at least. The pull would be much greater with increase of wind, with very little increase of height.

WILLIAM A. EDDY.

Bergen Point, N. J., Aug. 14, 1894.



RAISING AERIAL THERMOGRAPHS BY MEANS OF KITES AT BLUE HILL OBSERVATORY.

METHOD OF CONSTRUCTION OF THE KITE.

As success in flying the Malay kite depends largely upon the accuracy with which the kite is constructed, we give the following directions in regard to how the kite should be put together. The sticks should be made of clear spruce, as this has been found to be less liable to bend under strain or break at the cross stick.

Cross section of each stick is $\frac{5}{16}$ by $\frac{1}{2}$ inch.

Kite stick A B = $68\frac{4}{10}$ inches.

Kite stick C D = 60 inches.

O = center of gravity, which is 35 per cent of C D from the top of C D. The center of gravity is the point at which the completed kite should balance when supported by the finger in a horizontal position. In strong winds A B = C D and the kite is narrowed. C E = 18 per cent of C D in both strong and light wind kites. The thin manila paper should be put on the kite slightly loose. The deepest part of the bow of the cross stick A B should be about $\frac{1}{10}$ of the length of A B. The lower part of the kite should be strung first, and the eye should not be trusted in assuming that A D = B D. In bending A B great care is required to see that the bend on each side of the point of junction at E is equal. The slight bagging inward of the paper covering triangles A E D and B E D should be equal. If the kite flies sideways, owing to inequality, it can be partly remedied by tying small half or quarter ounce weights at A or B. If A swings too far to the left, tie the weight at B, and if B swings too far to the right, tie the weight at A. The hangers or bellyband drawn in the side view of the kite, fastened to E and D only, make a right angle at E and an acute angle

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at D, as shown. The point of junction where the flying line is attached, if necessary, may be retied and shifted up and down an inch or two in the wind, in order to attain a proper line of flight. If the flying knot is too high, the kite will whirl incessantly without rising. The string running from flying knot to D can be from 89 per cent to 92 per cent of C D. From the flying knot to E can be made 56 per cent of C D.

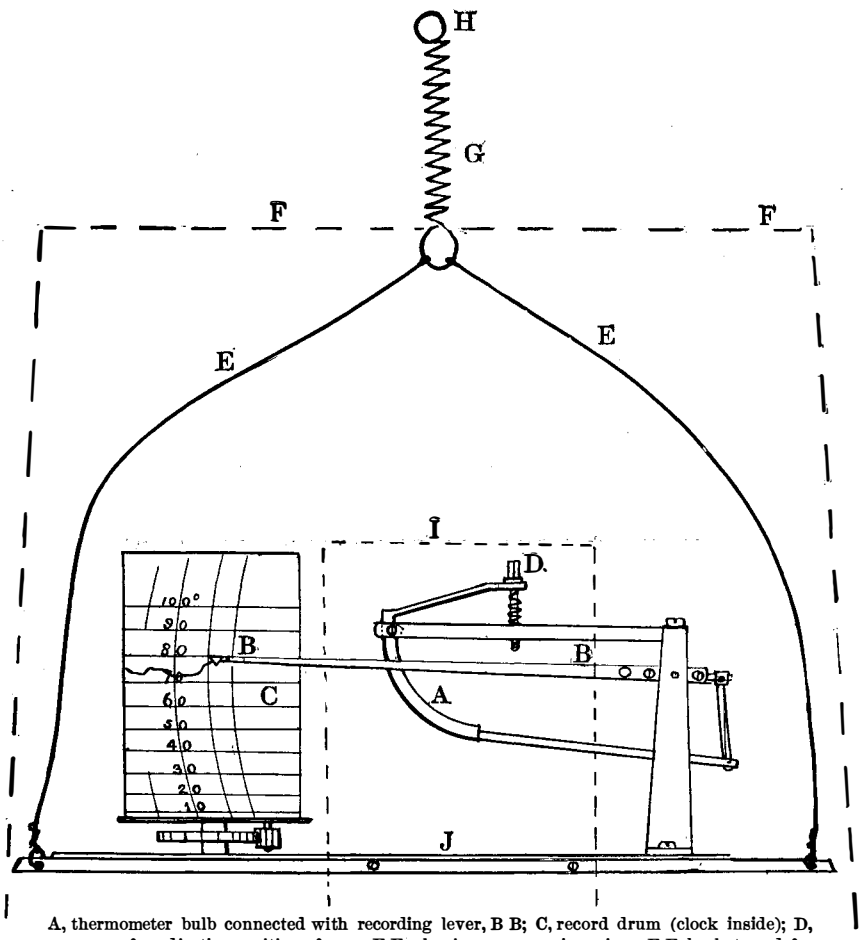
The thermograph used in the experiments is shown in the accompanying cut, which was prepared from a drawing sent us by Mr. H. H. Clayton, of Blue Hill Observatory, whose letter we publish herewith.

THE AERIAL THERMOGRAPH.

Mr. S. P. Fergusson has prepared a sketch of the thermograph sent up with Mr. Eddy's kites, and also shows the method of attaching it to the string. The sketch is inclosed herewith. The thermograph was in reality a small Richard thermograph remodeled by him, the heavier parts being replaced by aluminum, the recording parts included in a small space, and hard rubber used for the base, so that the total weight when completed was only one pound eight ounces, the original weight being eight pounds. A small sheet of aluminum weighing two ounces was arched over the thermometer bulb, and a light basket weighing ten ounces was inverted over the whole, thus making the total weight, with double shelter, two pounds four ounces. This was sent up approximately 1,400 feet above the top of the hill, which is 640 feet above the sea level and about six miles inland. The angular measurements were made with boards used for a rough theodolite at the ends of a 360 foot base line, but numerous measurements were made, and the probable error in altitude is not greater than 200 feet.

The thermograph was up about four hours, and it was found to be about six degrees colder at the highest point than on the earth's surface. Such observations repeatedly made ought to materially increase our knowledge of the laws of decrease of temperature with altitude in the lower air, and if great altitudes can be attained, as seems probable, one of the greatest desiderata of modern meteorology, namely, observations in the upper air, will be obtained at a comparatively small cost and in a simple manner. We hope in future to send up an instrument which will record temperature, pressure and wind velocity; perhaps, also, humidity. Mr. Fergusson believes he can construct such an instrument which will not be beyond the lifting power of the kites.

H. H. CLAYTON,
Asst. Blue Hill Observatory,
Readville, Mass.



A, thermometer bulb connected with recording lever, B B; C, record drum (clock inside); D, screw for adjusting position of pen; E E, aluminum suspension wires; F F, basket used for sheltering thermometer from sun; G, spring for checking oscillations caused by jerking of kites; H, ring to which kite cord is secured; I, inner screen; J, base plate of hard rubber. All other parts of aluminum except bulb and clock mechanism.

THE AERIAL THERMOGRAPH.

Rice Paper.

The rice paper tree, one of the most interesting of the flora of China, has recently been successfully experimented with in Florida, where it now flourishes with other subtropical and Oriental species of trees and shrubs. When first transplanted in American soil the experimenters expressed doubts of its hardiness, fearing that it would be unable to stand the winters. All these fears have vanished, however, and it is now the universal opinion that it is as well adapted to the climate of this country as to that of the famed Flowery Kingdom.

It is a small tree, growing to a height of less than 51 feet, with a trunk or stem from 3 to 5 inches in diameter. Its canes, which vary in color according to season, are large, soft, and downy, the form somewhat resembling that noticed in those of the castor bean plant. The celebrated rice paper, the product of this queer tree, is formed of thin slices of the pith, which is taken from the body of the tree in beautiful cylinders, several inches in length.

The Chinese workmen apply the blade of a sharp, straight knife to these cylinders, and turning them round either by rude machinery or by hand, dexterously pare the pith from circumference to center. This operation makes a roll of extra quality paper, the scroll being of equal thickness throughout. After a cylinder has thus been pared it is unrolled and weights are placed upon it until the surface is rendered uniformly smooth throughout its entire length.

It is altogether probable that if rice paper making becomes an industry in the United States these primitive modes will be done away with.—St. Louis Republic.

THE upper third of the face is altered in expression, say physiognomists and doctors, in affections of the brain, the middle third in diseases of the chest, and the lower third in diseases of the organs contained in the abdominal cavity.

Our New Army Rifle.

The Army and Navy Journal says: Soon the historic Springfield rifle, which, as a muzzle loader and breech loader, has played such a prominent part in the nation's wars, will have passed away into history. For the first time since this country was a nation we have set aside native talent to seek abroad for the weapon with which to arm our troops. When the English abandoned their Martini-Henry two years ago, they were able to find among the inventions of this country a small arm which they then thought superior to any other, and experience thus far has confirmed this judgment. When our new arm has been subjected to the same practical tests in the hands of our troops we shall be able to judge whether or not we were wise in establishing the precedent of rejecting the product of American invention. The final conclusion of the experiments the navy are making will throw further light on this question. Our army will have a rifle with a caliber one-third (0·300) of an inch in measurement. The bore will just about admit the ordinary lead pencil, which would fit closely. The caliber of the navy gun will be still smaller. Ever since the introduction of the breech loader into modern armies the tendency has been toward a reduced caliber. England's first military breech loader, the Snyder, was 0·577 of an inch in the bore; the Martini-Henry was of 0·45 caliber, and fired a brass shell cartridge containing 85 grains of powder and a 480 grain or ounce bullet. Our Springfield is 0·45 caliber, with a bullet of 405 grains and a powder charge of 70 grains. Our new arm is 30 inches in the barrel, with a magazine horizontal, that is, lengthwise with the barrel. This magazine contains five cartridges, and has a cut-off, so that the piece can be used as a single shot arm and the rapid fire of the magazine held in reserve, while the firing of single shots goes on at the rate of 30 per minute. The entire arm weighs about eight pounds, including a knife-shaped bayonet. The bayonet is quite as great a departure from the old style weapon as is the arm. The familiar three-cornered piece of steel belonging to the infantry military arms of all nations for 150 years has given way to the knife blade form of bayonet. All the European nations have adopted this pattern, with the new small bore, except Russia, and that power is seriously considering the change. The blades of the modern bayonets are from 9 to 12 inches in length and an inch wide. The American bayonet will be 12 inches long. The handles are short and straight, not more than four inches in length, and are made of wood and steel. The entire weight of the knife bayonet is about three-quarters of a pound. The sights of this rifle are adjusted to a range of 2,500 yards. Though the bullet is fatal at 3,500 yards, it has not been deemed necessary to attempt any sighting beyond the range mentioned, as anything like an accurate aim beyond this distance would be impossible.

But the interest in the new arm culminates in the cartridge it fires. This weighs about one-half as much as the old 0·45-70-405 Springfield cartridge. As the new arm is much lighter than the old, the soldier can carry 175 or even 200 rounds of the new ammunition without any increase of load beyond what the old cartridge gave when but 100 were carried. The charge of powder for the United States rifle is now 37 grains of a German smokeless explosive, known as the Wetteren. Something very like it will be adopted for permanent use. This was chosen because it gave but little smoke, if any. Its burning produces a mist-like vapor, and the report is about one-half as loud as that of the service charge of black gunpowder. The bullet is about an inch long, of hardened lead, with a very thin covering of nickel or steel. In order to insure to so long and slender a missile steadiness of flight over such enormous ranges a more rapid twist in the rifle became necessary. The barrels of the new rifle have four grooves about 0·003 of an inch deep. They have one turn in about 12 inches, or two and a half complete twists in 30 inches. A long and slender bullet fired with the extreme velocity of 2,000 feet per second would not take the rifling in arms with so short a twist at all, but would "strip" or jump the grooving and leave the gun nothing but a shapeless slug of lead. In order to overcome this, the hard metal coating of the bullet was necessary, as well as the increased hardening of the lead used in the projectile.

For this reason, the size of the bullet is greater than the bore of the rifle by an increase equal to the depth of the grooving, and the missile is, therefore, forced into the rifling instead of sliding over it. A proper lubricant is used with these bullets. The heat produced by this new powder is intense. Twenty rounds rapidly fired would make the piece almost too hot to handle, unless the barrel was covered. The heat of the powder is much increased by the rapid friction of the hard bullet upon the inner surface of the barrel. The Germans have covered the rifles with a metallic skin, with an air space between it and the heavier metal. Other countries use a wood casing where the hand must touch the arm. The United States will adopt this method. The smokeless powder was made necessary in the new arm for several reasons. The chief one was that, even with the black powder obtainable, the inside of the barrel became so foul in a few rounds that the firing was very wild and uncertain, and there was no telling where the bullets would go. At a distance of 200 yards the bullets would be scattered all over a two foot target, so that anything like the required accuracy became impossible. The second reason for a new powder was, that no combination of ingredients would give sufficient force to drive the projectile to the desired range. To overcome these and other disadvantages white, or smokeless, powders were used. They are a trifle more expensive than those of the old kind, but possess infinitely greater driving force. Then, too, the combustion being chiefly gaseous, the unburned residue is extremely small. The smoke given out is almost unnoticeable, and it scatters so rapidly as to produce no effect of blurring. But the new bullet is the marvel of this model invention. It is usually about four calibers in length, stiffened, as has been said. Its range and power are almost beyond relief. At a distance of 30 feet from the muzzle of the rifle fired, the bullet penetrated 24 inches of white oak, seasoned two years. At 200 yards, it went through 45 inches of poplar planks, each three-quarters of an inch thick and the same distance apart. At the same distance the missile penetrated 30 inches of hard pine. At 2,000 yards it passed entirely through a horse's body at the shoulders, and at the same distance it would go through the bodies of three men. At 2,800 yards it penetrated four inches of deal planks, and at 3,200 yards it still had enough power in it to pass through a human body. These results are well verified, or they would be almost past belief.

ACCORDING to a patented process artificial citric acid may be made by acting on solutions of sugar, starch, glycerol, and analogous substances with two new species of hyphomycetes, called citronycetes. These fungi are obtained by allowing sugar solution containing two to five per cent of citric acid to stand a few days, then removing the fungi produced, and cultivating them in sterilized sugar solution. The pure culture is introduced into sugar solution containing a small quantity of mineral salts, and the liquid is allowed to stand at the ordinary temperature for 8 to 14 days. On evaporation, the citric acid separates; or it may be obtained as lime salt by adding lime or carbonate of lime to the solution after or before the fermentation.

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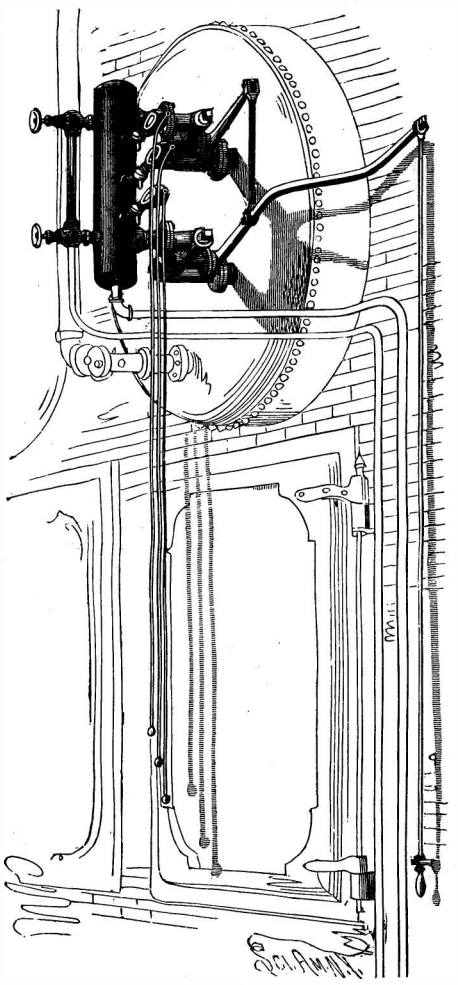
ALLIS STEAM ENGINES, OILING SYSTEM AND SUBSIDIARY APPARATUS IN THE EASTERN POWER HOUSE OF THE BROOKLYN CITY RAILROAD CO.

(Continued from first page.)

water, should a gauge glass break. The cut showing the apparatus for doing this, which was designed by Mr. James Anderson, chief engineer of the station, will be found self-explanatory. Two shut-off cocks are connected one to the steam the other to the water pipe; the two cocks are connected together by connecting rods, and one of the connecting rods has attached to the end of its extension a rod and pull, by the pulling of which both faucets are simultaneously closed. The handle on the rod is secured in a holder leaving the cocks open. Should the gauge glass break, anybody can by a single pull of the handle instantly shut both valves.

In order to deliver dry steam to the engines baffle plates are at intervals introduced in the main to catch and deposit water from the wet steam. The water runs to a central collecting tank, and our illustration shows the tank with water pouring into it. This water comes from the steam mains, and is that which is collected by the baffle plates. A steam pump is constantly at work pumping water out of the tank, thus maintaining the same level at all times. Within the tank is a float attached to a rod. As the float rises and falls by the intermediation of a lever, connecting rods, and a rock shaft, it operates a water valve. This water valve connects with the city water,



STEAM AND WATER CUT-OFF FOR LEVEL GLASS.

and as raised or lowered it admits water above or below a piston in a small hydraulic cylinder, shown in the upper right hand corner of the cut. The effect of raising this piston is to open the steam valve and give a further supply of steam to the pump shown in the lower right hand corner. This pump delivers water from the tank to the boilers. As the piston under the influence of the water pressure rises, it operates a lever which is seen underneath the shelf or support on which the cylinder and water valve rest, and as this lever is operated by the rising piston, it pulls down bodily the outer valve casing, thus again shutting off the water and letting the water piston come to rest. The reverse operation also takes place, so that in the entire connection of steam pump, automatic valve, and water lever regulator, we have a complete apparatus for keeping a level absolutely constant in the tank by varying the running speed of the pump, which forces its water into the boilers. The tank, therefore, receives the drainage of water from the steam mains, whence it is pumped back to the boilers. Should the float ball rise, the pump works faster, and if it descends, the pump works slower.

One of the illustrations shows the oiling system, like the last described apparatus, the invention of Mr. James Anderson. In the upper left hand corner of the cut are seen oil tanks, some above the others; to the lower tanks the oil goes from the upper ones, passing on its way through filters, which remove all solid matter.

From the lower level tanks pipes run to the engines and distribute the oil to all the journals and to the cylinders. From the journals and cylinders the excess of oil runs to tanks in the cellar, where it is collected to be pumped again to the uppermost tank, whence it passes again through the filters to the pressure tanks and then to the journals. In this way oil is kept constantly circulated through the system, under a head of about 15 pounds. New oil is only added when the indicators show that it is required. In this one station 1,200 gallons of oil are kept constantly in circulation. On a board in the engine room are mounted indicator dials showing the exact level of the different kinds of oil, engine oil and cylinder oil, in the storage and pressure tanks and receiving tanks and in the filters, so that at a glance the exact condition of the oiling apparatus can be seen. On the same board is mounted a single working steam gauge, which has thirteen pipes connected through a manifold, each pipe having its own valve. These pipes run to different parts of the system, so that by opening any different valve the pressure at the place to its pipe is at once given. The advantage of this system is that but a single pressure gauge is used, so that there is no chance of error from difference of valve readings. A test steam valve is connected to the manifold to act as a check upon the other one.

Man a Laboratory of Poisons.

Since attention was first directed to the part played by bacteria in the communication of disease, very close study has been devoted by the profession to the whole subject of infection, and one of the most interesting facts discovered in this connection is that the organism may be poisoned by the products of its own making. This auto-infection, as it is called, was the subject of a paper by Dr. Hickman read before the Medical Society of the State of Washington, May 3, and republished in the Medical Sentinel. Dr. Hickman argues as follows:

"It is known that in the normal process of digestion of ordinary foods, there are formed at certain stages products which, if thrown into the circulation, will produce alarming symptoms and even death. Now suppose that portion of the digestive machinery whose function it is, in some way or other, to dispose of such toxic product, be unable to perform its task and the toxin be absorbed. Or, to be more specific: It has been established that the urinary tract from the tubuli of the kidney to the meatus is a non-absorbing surface. Now rob it of its epithelial covering at a point where the urine is constantly in contact with it, and the organism becomes speedily intoxicated. . . .

"In the whole range of animate existence it has been found that the excretions, in conditions of health, contain elements that are poisonous, and I venture to predict that in the near future much light will be thrown upon many pathogenic processes, not yet well understood, by a more careful study of the excretions. . . . Now if these poisons are present in greater quantities than can be disposed of, then the system will be infected and intoxication must ensue. . . . Thus it becomes a scientific fact that we are continually on the brink of destruction by reason of natural processes.

"As one observer says very aptly, we are a laboratory of poisons. Then why do we not succumb? The reasons lie with the excretory organs and with the liver. The liver has been found to separate from the blood very many poisons and to destroy some. Schiff ascertained that by injecting certain alkaloids into a branch of the portal vein the proportion of the poison in the blood as it came from the liver was much lessened. He also found that a definite amount in proportion to body weight of nicotine as well as other toxical kaloids, would, when injected into a peripheral vein, produce intoxication; this same quantity, when injected into a branch of the portal vein, would not produce any result. He further found that such a dose of nicotine as would only intoxicate when injected into the portal vein would kill after tying the portal vein. These experiments make positive proof that the liver destroys a certain amount of toxic substances. It was also found that, when certain alkaloids in doses known to be toxic were triturated with liver tissue, the result of the infusion injected was nil; the same quantity, when triturated with muscle or kidney tissue, invariably killed. . . .

"In the light of these facts we must admire the therapeutic sagacity of our forefathers in medicine, who were continually having such a watchful eye for torpid livers, and we may well take a hint from them. As to the excretions, we have not time even to gallop across this field; but we will all do well to fasten in our minds the important therapeutic hints we may glean from this study.

"Brunton has told us that the feeling of lassitude and drowsiness after measles is due to the absorption of toxins derived from proteids, and that these sensations decrease upon a diet devoid of proteids. Is it not likely that the nervous phenomena of indigestion are due to the absorption of toxins?

"It would be interesting to consider the factors of so-called biliousness; we would learn that auto-infection is at the basis of these conditions to an extent greater than ordinarily believed. Think of the large array of ailments due to the absorption of imperfectly oxidized products of digestion. Uræmia is no longer believed to be due either to the absorption of urea or to its defective elimination, but rather to the influence of various poisons normally eliminated by the urine; thus is explained that we sometimes observe convulsions and again coma.

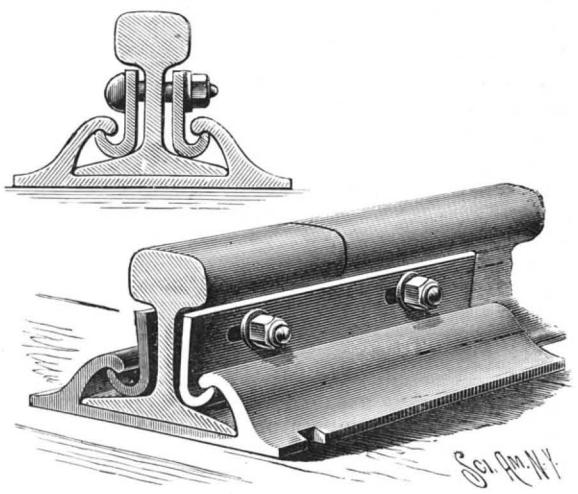
"It is very likely that certain forms of chlorosis are due to auto-infection; very certain is it that a treatment based upon this idea is often more successful than the usual ferruginous treatment. Whence comes the so-called bilious taste in the morning? The bile is tasteless. It must be, as suggested by Brunton, an alkaloid excreted by the salivary glands.

"I have under treatment a case of cirrhotic kidney, who will have a brief chill almost every day, followed by a headache and dizziness, unless his bowels or skin are kept active.

"Certain headaches recurring at greater or less length of interval are only explainable upon the basis of self-infection and are certainly amenable to a treatment along the lines indicated."

AN AUTOMATIC RAIL JOINT.

In the improvement shown in the illustration the rails are bound to the chair and the chair is drawn to the rails by means of spring steel side levers, designed to recover all wear as it takes place. The invention has been patented by Dr. M. O. Perkins, of Galveston, Texas, and has been previously noticed in our columns. When the nuts are tightened until the side arms stand perpendicular, a powerful force is exerted at that portion which rests upon the rail flange and at the toe or lower extremity of the side arms where they engage



PERKINS' RAIL JOINT AND NUT LOCK.

the chair, the spring also acting against the nuts as a complete nut lock.

Flowering Annuals.

M. Arnot, writing to the Garden and Forest, says: At this season there is no lack of color in our gardens where a proper use has been made of these plants. The dwarf sunflowers, nasturtiums, China asters, marigolds, coreopsis and many others are very useful when quantities of flowers are needed. Delphinium consolida is still very beautiful, with its long racemes of intense blue flowers, which continue to show themselves in spite of drought. The many beautiful forms of the perennial larkspurs have pushed this plant aside somewhat, but it deserves a place in every collection of annual flowers. Of course, there are many varieties, double and single, and the colors range through various shades of blue and white and pink, but none are more beautiful than those of a clear deep blue. The China asters have been changed by selection and crossing till the plants differ as widely in habit as they do in the color and shape of the flowers. One can hardly go amiss in selecting from the approved strains of the best florists, whether plants are wanted for bedding or for cutting. As the nights begin to grow cool the single-flowered dahlias, and especially the dwarf kinds, are beginning to do their best. They come in almost all colors, combinations of colors, and form broad plants hardly more than eighteen inches high, so that they need no stakes, and produce flowers in the greatest profusion.

The practice of sowing the seeds of the hardier annuals in autumn is one to be altogether commended. Those which bloom only once will flower earlier, and with much greater vigor, while those which continue to bloom for a long time develop into a size which spring-sown seedlings never attain. A plant of Coreopsis drummondii, for example, will have stems an inch through and cover a space a yard across.

IN London the work in connection with the Waterloo and City Underground Railway is proceeding on the south side of the river near Blackfriars Bridge. Pile driving has been commenced at this spot, where it is also intended to sink caissons, and eventually construct two tunnels, one going to the Mansion House and the other to Waterloo Station.

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[FROM THE MEDICAL RECORD.]

Trephining the Frontal Bone for Chronic Headache.*

BY J. MARSHALL HAWKES, M.D., NEW YORK.

One June 31, 1891, Mr. M——, aged 28, applied to the writer for relief from headache of twenty years' duration.

The history of the case is as follows: When 8 years old, while playing in a yard in the downtown tenement house district, he fell on a curbstone and received a cut in the upper right quadrant of the forehead, about an inch above the supra-orbital ridge and parallel with it. His mother took him to the nearest druggist and had the cut dressed with adhesive plaster, after the manner of the time. The cut suppurated and healed slowly. He soon began to suffer from head aches in the upper right frontal region. They increased in severity during his youth and young manhood, until they became quite unbearable. Indeed, he was unfitted for work at least one day in the week and frequently for two days. These headaches were practically continuous. If he awoke in the night he felt the pain, and it was subject to frequent exacerbations, accompanied by "attacks," as he termed them. These attacks consisted of a severe paroxysm of pain, accompanied by dizziness, making him feel very weak, so that he would usually, though not always, fall wherever he happened to be.

At no time during these attacks did he have a convulsion, or even a slight convulsive twitching. He was never unconscious, always knowing every one about him. He never vomited, nor bit his tongue or cheek, he never hurt himself when he fell, nor did he ever fall in a dangerous place, though he frequently remarked to his friends that it was strange that he did not. He always had a premonition of an attack. No exciting causes were apparent, though he declares if the wind blew hard in his face the headache would become worse. He had them when a boy in school and after he began to work. Again and again he had to be led home by his fellow-workmen or sent home in a carriage. He had no more "attacks" when he was working than when he was not. He had never had any illness, not even measles.

The treatment of various physicians and attendance at two of the city hospitals for varying lengths of time had not produced any amelioration of his condition, and, at the time he came to me, his condition so preyed upon his mind that he feared he would become insane.

On examining his head in the region above indicated, a small indentation, scarcely an eighth of an inch in length and of only slight depth, was found, and it was only after questioning the patient at great length that he remembered exactly when he received the injury as above elicited, though he was positive of his age (eight) at which the headaches began.

Since the accident had happened so long a time before, and because the writer could learn so little of his previous history, it was deemed only prudent to eliminate the various other causes of headache, such as eye strain, stomachic derangement, disease of the kidney, etc. He was therefore sent to Dr. Knapp, who examined his eyes and found them both normal. He was dieted most rigorously on milk and the whites of eggs for some time, without any relief.

As no trouble could be found and all medical treatment was unavailing, the impression became more and more fixed that the inner table of the frontal bone had been fractured, and that the resulting exostosis, or possibly a pacchionian granulation pressing on the brain, was the probable cause, and that trephining might give him relief; certainly nothing else would. He readily consented, and on July 30, 1891, a semicircular incision was made surrounding the scar tissue marking the seat of the accident. When the scalp was turned back there was seen to be a slight depression in the skull not over half an inch in length. Following the surgical indication, the trephine point was placed in the center of this depression and a disk of bone, three-quarters of an inch in diameter, was removed. On examination, this disk was found slightly thickened at its upper margin, where normally it should have been slightly thinner. There was, however, no well-defined mark of fracture. As the dura mater appeared perfectly normal, there was no call for further search. The trephine hole was carefully burnished, every rough particle being removed, so as to leave no possible chance for irritation. The scalp wound was then carefully sutured with black, iron-dyed silk; no drainage was deemed necessary.

In five days the stitches in the integument, thirty-seven in number, were removed. At the first dressing, on removing the bandage, release of the pressure caused the patient to have a slight epileptiform seizure; the twitching of the body was general. Conjecturing that the sudden removal of pressure was the probable cause of the trouble, gentle pressure was made upon the area representing the uncovered portion of the brain, and at once the spasm ceased. The wound united promptly and in seven days the patient was on the street.

From the moment of etherization until now, the patient has had no headache. He expresses himself as very much delighted with the result. He goes so far as to say that he is "beginning life anew."

The hole in the skull has nearly filled with a fairly dense fibrous tissue, through the center of which, however, the pulsation of the brain can still be seen and felt.

1343 Lexington Avenue.

*Read at the June, 1894, meeting of the New York County Medical Association.

Increased Production of Cotton in Egypt.

The growth of the imports of Egyptian cotton to this country, says the Textile Record, is one of the most remarkable of the incidents connected with our textile industry. This business began so recently as 1884, so that it has attained its present considerable proportions within a period of ten years. In 1889 the imports of the staple to the United States amounted to a little less than 3,000,000 pounds. In 1893 they had reached the quantity of 28,000,000 pounds. The Egyptian staple is valued here because its unusual length permits it to be spun into soft yarns. For that purpose it is mixed with domestic cotton and the yarns are used for hosiery and other knit fabrics. Indeed, the increase in the use of Egyptian cotton has been coincident with the extraordinary development of knit goods manufacture in the United States. Simultaneously a demand has appeared for Peruvian cotton, of which, in 1889, this country took only 2,773 pounds, while in 1893 the imports amounted to 3,411,619 pounds. This fiber in many particulars resembles wool, and it is very serviceable for mingling with wool in the knit garments of wool and cotton, for which there is a great demand.

AN underground railway is fast nearing completion in Paris. The interesting feature of the work, from an engineering point of view, is the manner in which the tunnel was built, a masonry arch being used for nearly the entire length. The line follows the streets, one-half the street being closed in short sections at a time. It will be the first section of a metropolitan system in Paris.

RECENTLY PATENTED INVENTIONS.

Engineering.

BOILER.—Thomas A. Myers, Mendon, N. Y. The boiler patented by this inventor provides for sets of tubes extending horizontally in the shell, the two tubes of each set having their outer ends connected with each other and their inner ends joined to oppositely arranged vertical steam drums. The boiler is more especially designed for gas or petroleum fuel, for which the construction is simple and durable, and the operation is designed to be most economical and effective.

LOCOMOTIVE SPARK ARRESTER.—Joseph McMurrin, Shoshone, Idaho. A conoidal deflector, according to this invention, is arranged, point downward, above the top of the stack, and the latter is surrounded with a jacket having a flaring top around the edges of which is an inwardly extending flange overhanging the outer edges of the deflector, whereby the smoke may pass freely outward while the sparks will be thrown down into the space between the smoke stack and jacket.

OIL BURNER ATTACHMENT.—Bradford Cross, Moline, Ill. This is an attachment for facilitating the burning of oil in furnaces, being securely fastened to the furnace, and permitting the burner to be adjusted in and out and turned into any desired position. It has an adjustable deflector for turning the flame of the oil burner where desired, the deflector protecting the brick work and also the mouth of the burner, as well as better vaporizing and mixing the oil and air to effect the most complete combustion.

Railway Appliances.

CAR LOCK.—Charles E. Buckley, Green Lane, Pa. This lock is arranged on one edge of the door instead of on its outer face, so that it is not liable to be knocked off or bent. It comprises a casing with an opening, in which a projecting shaft is mounted to turn, an arm turning with the shaft projecting through the opening, and a head being secured to the projecting end of the shaft, while a post secured to the casing adjacent to the head extends parallel to the shaft, the post being adapted to be locked to the shaft.

CAR COUPLING.—Thomas Seyfried, Upper Nazareth, Pa. This is a coupling of the link and hook type, adapted for the automatic coupling of two meeting cars, the uncoupling being readily effected from the side of the car. The link may be readily elevated and lowered to have a coupled engagement with an another coupling of the same construction on a car that is higher or lower.

SAFETY FENDER.—Henry S. Robins, Philadelphia, Pa. This is an improvement on a formerly patented invention of the same inventor, simplifying the construction, and providing for making the body in two sections, one separated from the other, and forming the flexible guards in the shape of tubes of elastic material, having spring connection with the frame, the forward guard being elevated or lowered to approach the track more or less closely. Ready access to the car coupler is also provided for.

Electrical.

DRY BATTERY.—John I. Solomon, New York City. This battery is made of a glass jar, a curved plate of zinc, a carbon rod, a mixture of granulated black oxide of manganese and granulated carbon cemented together by chloride of zinc and surrounding the rod, a bag of textile material surrounding the carbon-manganese mixture, a filling of sawdust saturated with a solution of sal-ammoniac, and a seal filling the upper portion of the jar and surrounding the carbon and wire leading from the zinc. A vent tube extends from the sawdust filling through the seal.

Mechanical.

RING FRAME SPINDLE.—Ernst Gessner, Aue, Germany. The spinning spindle, according to this invention, has its tip or extreme upper end recessed and provided with a swiveling frictional thread guide held in the recess, the guide having a loosely hung or jointed hook or loop adapted to be turned up into alignment with the spindle to permit of the doffing of the cop. The part of the guide in frictional contact with the spindle may be varied as to form and construction, and the improvement affords advantages designed to be of great value in the production of soft yarns of short staple material.

PLUMB RULE.—Frank Holt, South Pittsburg, Tenn. This is an improvement on a formerly patented invention of the same inventor, whereby the rule can be securely held in place, and the slide-carrying ropes readily adjusted to enable the masons to properly lay the courses of bricks between two corners of a building. The rule has two blades arranged at right angles to each other, and a slide adapted to carry a cord or rope for each blade. The rule can be readily fastened in place on the corner of a wall and the cords independently adjusted on opposite sides of the wall.

ORGANZINE SPINNER.—Joseph Duffy, Paterson, N. J. This invention employs the well known method of driving by a continuous belt, affording a very simple apparatus designed to make perfect organzine warp, and so constructed that the breaking of a thread will at once stop the winding and spinning mechanism which carries the thread. Combined with the endless traveling belt are oscillating bolsters and the fixed trunnion on which the bolster arms are pivoted, while a pin is fixed vertically in rear of but contiguous to the bolster, and a plate spring is held detachably between the trunnion and pin, its ends bearing on the bolster spindles.

Agricultural.

BROODER.—Danton O. Brunner, Somerset, Ohio. This is a simple, durable and economic construction for protecting young chickens or other fowls without the aid of their natural mother, affording warmth, dryness and ventilation, and being quickly and easily cleaned in all its parts. In its upper part is a heating pan, in which is water warmed by a lamp in an outside extension of the body of the brooder, while below the heating apparatus is a chick chamber, at each end of which is an air chamber, these chambers communicating with other inclosed chambers. Beneath the heating device is a mother, consisting of a movable frame carrying a perforated partition, with curtains, below which is supported the chick floor.

Miscellaneous.

BOW-FACING OAR.—Benjamin F. Kimsey, Terre Haute, Ind. The oar, according to this invention, is made in two sections, having meshing gears at their adjacent ends, a bearing member joining the gears and a supporting guide being secured to the boat. The bearing member is held on the guide for a rocking movement and adapted to be moved laterally. With this improvement the oarsman can sit facing the bow of the boat in rowing. It may be connected with or disconnected from a boat in a moment's time, or the blades may readily be folded up close to the sides of the boat when desired.

DYNAMITE.—Harry A. Callahan, Bradford, Pa. (William C. Callahan, administrator.) This explosive may be made of a high or low grade as desired, and is designed to be safe to transport and handle. It is made of nitroglycerine and a mixture of pulverized coke and acetate of lime, prepared in a manner set forth and in differing proportions or weights, according to the uses to which the explosive is to be put.

MEASURE AND FUNNEL.—Benjamin G. Reese, Mount Carmel, S. C., and Drury B. Cade, Overton, Ga. According to this improvement, the body portion of the measure has a funnel-like bottom, in which is a straightway cock, there being in one side a sight opening or gauge, while a screen may be detachably fitted in the top of the body, which has a handle and hook members or ears. The device is simple and inexpensive and strains the fluid as it enters the measure.

FOUNTAIN MARKING BRUSH.—Albert G. Carling, Ellenville, N. Y. The hollow handle piece of this device forms an ink receptacle, and is detachable to permit the use therewith of brushes of different sizes, having an elastic triangular extension at its lower end. The brush has a coniform hollow shank, from one end of which the bristles protrude, while a skeleton frame extends from the other end of the shank, and a tubular tapered holder piece for the brush is detachably connected to the handle piece.

PORTABLE FOOT WARMER.—Isham Boyd and Benjamin Hardesty, Eminence, Ky. This appliance is connected with a tank of burning fluid to be conveniently located in front of the dash board or on the vehicle body, and a feed pipe connects with a vapor burner within the light sheet metal case of which the warmer is made. The case is made in two sections, and in its upper part are apertures in which are foot rests which may be rocked. A needle valve regulates the action of the vapor burner. The apparatus may also be used as a temporary stove, for indoor or outdoor use, to cook a meal or warm victuals for a lunch.

WINDOW OR DOOR BUTTON.—Stephen C. Black, West Chester, Pa. This is an inexpensive, simple and readily applied lock, by which the sashes may be locked in any desired position in relation to each other, or either sash may be locked independently, as desired. There is on one sash a perforated fixed plate, and a movable spring-pressed plate held in a groove of the other sash has an arm projecting through the perforation of the fixed plate, a forked lever pivoted on the arm embracing it, while there is a guide lug for the lever on the fixed plate.

SASH BALANCE.—Sanders B. Sutton, North Baltimore, Ohio. This invention relates to balances in which the cord winds on spring-acted spools, a novel manner of arranging and mounting, which is provided, together with novel tension and brake devices for the spool. The frame and spools are carried by a removable piece, facilitating the making of any repairs, and the springs are so arranged that the sash is properly balanced.

LOCK.—Bradford S. Miles, Gray's Summit, Mo. This is an improvement on a formerly patented invention of the same inventor, giving increased security in a simple, cheap and practical manner. The lock has a number of pendent and peculiarly formed blocks, the locking blocks being introduced between guard blocks, the key moving an intermediate locking block of the set, and affording a lock mechanism which gives great security, and is yet not expensive.

BREAST SUPPORTER.—Mary Tucek, New York City. This is an article for ladies' wear, to be supported from the shoulders, and designed to take the place of the usual corset. Its lower portion is formed of sheet metal plates, covered with silk, canvas or other material, to whose concave top edges are attached partial pockets of suitable textile fabric.

PROTECTOR FOR EXPOSED SEATS.—George H. S. Farrant, Bemerton, England. A combined seat back and automatically closing cover for protecting the seat from rain, snow and dust, has been devised by this inventor, the invention being more especially adapted for outside seats of public vehicles and boats and seats in parks. The seat back and cover is hinge-jointed to the seat frame in such manner as to form a rigid back for the seat when raised, but it falls down and covers the unoccupied seat. It may be made of wood or metal, or as a light frame covered with waterproof material, and suitably padded to form a comfortable back support.

SIFTER.—Carl P. Eichler, Cleveland, Ohio. The sifter body of this device has a rigid handle bail, on which is a yielding handle, there being a revoluble stirrer within the body and an operative connection between the yielding handle and the stirrer to impart a rotary movement to the latter. It is designed for sifting flour, granulated sugar, spices, etc., and the construction is such that the sifter may be conveniently used to scoop up the material as well as to thoroughly sift it.

PORTABLE WATER HEATER AND STOVE.—Warren C. Dickerson, New York City. This is a very simple and inexpensive construction especially adapted for use in connection with bath rooms, etc. The faucet through which the water finds exit is so connected

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with the gas cock that when the water is cut off at the exit end the supply of gas is also automatically cut off, but when the supply of gas is cut off the exit of water need not be stopped. The water may be heated to a high degree in a short space of time, or the water attachment may be readily removed and the stove utilized for heating and cooking purposes.

STRIKING BAG. — Carl A. Forsberg, New Whatcom, Wash. An improved bag for the use of athletes and others practicing the art of boxing has been devised by this inventor. The invention consists of a round bottomed bowl-like base piece in which is a weight to hold it in upright position, or an equivalent spring, with a vertical central tube in which is a rod adjustable as to height by a set screw, there being a hollow rubber ball attached to the upper end of the rod. A rubber spring may also be used to replace the weight.

UMBRELLA LOCK.—Nathan B. Whitfield, Portland, Oregon. This is a lock for an umbrella-securing holder, in which the top or plate forms the stock, having an edge recess or notch, the lock with locking devices also having an edge recess or notch, and secured to the top with such recesses in register. The lock comprises clamps, a ward for locking them, and tumbler by which to release the ward, with blank plates and springs by which to actuate the plates and the clamps.

DESIGN FOR PEN WIPER.—Edward B. Wicks, Salt Lake City, Utah. This design is represented by a wheel whose axial support is held in upwardly projecting standards of a base piece, the face of the wheel simulating round edged steps, of smaller diameter at both sides of the center.

NOTE.—Copies of any of the above patents will be furnished by Munn & Co., for 25 cents each. Please send name of the patentee, title of invention, and date of this paper.

SCIENTIFIC AMERICAN

BUILDING EDITION.

SEPTEMBER, 1894.—(No. 107.)

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1. An elegant plate in colors, showing a Colonial residence at Portchester, N. Y., recently completed for Geo. Mertz, Esq. Two additional perspective views and floor plans. An attractive design. Mr. Louis Mertz, architect, Portchester, N. Y.
2. Plate in colors showing a residence recently completed for R. H. Robertson, Esq., at Southampton, L. I. Two perspective elevations and floor plans. A picturesque design and an admirable model for a seashore cottage. Mr. R. H. Robertson, architect, New York City.
3. Residence of Frederick Woollven, Esq., at Rosemont, Pa. Two perspective elevations and floor plans. A neat design in the Colonial style. Cost complete $4,800. Mr. J. D. Thomas, architect, Philadelphia, Pa.
4. A cottage at Roger's Park, Ill,, recently erected for Edward King, Esq. Two perspective elevations and floor plans. A unique design. Mr. Geo. W. Maher, architect, Chicago, Ill.
5. Cottage at Hollis, L. I., recently completed for the German-American Real Estate Co. Two perspective elevations and floor plans. Cost complete $3,200. Mr. Edward Grosse, builder, same place.
6. Perspective elevation with ground plan of Saint Gabriel's Chapel, recently erected at Hollis, L. I. A unique and most excellent plan for a small chapel. Cost complete $6,500. Mr. Manly N. Cutter, architect, New York City.
7. Two perspective elevations and an interior view, also floor plans, of a residence recently erected at Orange, N. J., for Homer F. Emens, Esq. Mr. Frank W. Beall, architect, New York City. A pleasing design in the Colonial style.
8. Perspective elevation and floor plans of a cottage recently erected at Flatbush, L. I., for F. J. Lowery, Esq. Cost complete $4,600. Mr. J. C. Sankins, architect and builder, Flatbush, L. I.
9. A residence at Yonkers, N. Y., recently completed for Mrs. Northrop. A very unique design for a hillside dwelling. Perspective elevation and floor plans. Messrs. J. B. Snook & Sons, architects, New York City.
10. Club House of the Sea Side Club, Bridgeport, Conn. A good example of Romanesque style. Perspective elevation and floor plans, also an interior view. Messrs. Longstaff & Hurd, architects, Bridgeport, Conn.
11. A residence at Hinsdale, Ill., recently erected for C. E. Raymond, Esq., at a cost of $7,000 complete. Perspective elevation and floor plans. Mr. J. H. Shannon, architect, Hinsdale, Ill.
12. The Castle of Bonnetable. Half page engraving.
13. Miscellaneous Contents: The irrigation of laws, illustrated with two engravings.—Viaduct for street railways, Cincinnati, Ohio, illustrated.—The fireproof building construction of the New Jersey Wire Cloth Co., illustrated.—Silvester's remedy against dampness.—Palmer's "Common Sense" frame pulley.—"The Old Hickory Chair," illustrated.—An improved hot water heater, illustrated.—The Caldwell Tower, illustrated.—The American Boiler Co.—The "Little Giant" floor clamp, illustrated.—The Akron air blast furnace.—Laundry glaze.—The "Piqua" metallic lath, illustrated.

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Notes & Queries

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References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.

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(6213) A. W. B. says: I send a box containing leaves of cutleaf birch on which are specimens for which I have no name. They have so far been found clustering on a leaf, that is a lot together as a rule, and so far at least have done nothing toward forming a nest. Please answer through the SCIENTIFIC AMERICAN, to which I have been a subscriber for about 15 years. Answer by Dr. C. L. Marlott, Acting Entomologist, Department of Agriculture. A. W. B. has happened upon the rare larva of one of the most interesting of the saw flies. The peculiarity of this insect consists in the expanded and flattened first tarsal joint of the hind legs, resembling very closely the similar expansion in the case of the honey and bumble bee. The larvæ have been found before on birch and on willow, but they are by no means common. The species is known scientifically as Craesus latitarsus. When full grown they will leave the tree, enter the soil and spin up a tough brown parchment cocoon, from which the following spring the adult will issue. They are probably double brooded, the second brood being the one now working on the trees. Saw flies are so named from the fact of the serrated ovipositor, with which the female cuts a slit into the leaf tissue or into the small twigs or leaf petiole for the insertion of her eggs. They include a number of our most injurious insects, such as the gooseberry and currant worms, and species which are very destructive to pine forests and other trees valuable for lumber. This particular species has, however, been hitherto so rarely met with that it is rather uncommon, even in collections.

(6214) J. C. D. asks: 1. What voltage is required to run motor described in SCIENTIFIC AMERICAN SUPPLEMENT, No. 641? Also amperage with no load and with full load, and the resistance of the motor? A. Allow 7 to 10 volts, and 14 amperes unloaded and 7 to 9 amperes loaded, field resistance 1·8 ohms, armature 0·8 ohm. 2. Can I reduce a 110 volt continuous incandescent current to the required voltage? If so, how? A. By high resistance in series with motor, at a loss of 90 per cent or more efficiency. 3. I have some Russia iron for the fieldmagnets of the motor, but it is too stiff. Can I anneal or soften it in any way without hurting it for the motor any to amount to anything? If so, how? A. By heating and slow cooling. Try shaping it while hot. 4. How fast will the motor run a 16 foot boat? A. Two or three miles an hour. 5. What size of propeller and what pitch are required? A. Diameter 12 inch, pitch 30 inch. 6. Also some simple way of making a commutator with 12 segments about ⅛ or 1 inch in diameter. A. There is no really simple way.

(6215) T. A. N. asks (1) if there is any inductive resistance in the field coils of a dynamo besides the actual copper resistance of the wire? A. There is impedance, owing to the pulsatory nature of the current. If it were absolutely uniform, there would be none. 2. In a good dynamo and motor, about what percentage of the current is used up by the magnets? A. If series wound, both field and armature receive the same current, the field absorbing the voltage varying with the work done. In shunt and compound winding the most varying ratios obtain.

(6216) L. H. asks: Why is it that an armature has twenty or thirty segments in the commutator and only four or five parts in winding? A. The more parts there are in a commutator, the more even, practically speaking, will the current be. To avoid trouble in winding, fewer parts may be used in the winding. Theoretically there should be commutator divisions for each individual wire. Often the commutator and the armature divisions correspond.

(6217) C. S. B. Jr. asks (1) if it makes any material difference whether the primary coil of an induction coil is wound over the secondary or the reverse? A. It makes very little difference. 2. If the secondary coil contains 1,500 feet of No. 30 copper wire, what length and size should be used for the primary to produce the highest voltage in the secondary? What would be the voltage in the secondary coil if the primary has 110 volts? A. The ratio is based on the relative number of turns of wire, not on the length. The turns of the secondary divided by those of the primary give a factor by which the original voltage is multiplied to get the secondary. But this is only approximate, although as a working rule it is extensively used. Your data are not sufficient for an answer to your query.

(6218) W. R. writes: Could you kindly let me know if storage battery, 4 volts, 15 hours (ampere) capacity, could be charged by a 110 volt motor run by Edison current or must I reduce the 110 volts by resistance equal to 4 volts, in about what time could I charge the battery? A. You must use resistance and work at a loss of efficiency of over 90 per cent. By using special lamps 105 volts and placing the cells in series with a quantity of them, the cells might be charged while the lamps were in regular use. With 30 lamps you might charge in ten hours.

(6219) R. C. L. asks how natural gas may be located, or in other words how can it be found? A. Gas is located by boring. No surface indication is of much value, short of an escape of the gas or of oil.

(6220) W. J. W. asks: 1. What is the difference in cost, if any, in rolling iron supports of say 20 or 30 feet and casting them? A. Rolled iron or steel supports or columns are much cheaper than cast iron, as the weight of columns or other structural work in cast iron is much greater than the inverse ratio of difference in price of the two kinds of material. 2. Does a high voltage tend to heat a wire? For example, take a wire that will safely carry 10 amperes, would it heat the wire to force 2,000 or more volts through it? A. A high voltage tends to heat a wire by forcing a stronger current through it than would be forced by a low voltage. You do not force volts through a wire—the volts force amperes through it. 3. Why is water a conductor to an alternating current and not to a continuous one? A. No such difference exists. Pure water is an almost complete insulator. 4. Could a current of 10 amperes and 2,000 volts be used as advantageously as one of 2,000 amperes and 10 volts on a street car line? If not, why? A. Considerations of safety prevent the use of too high voltage.

(6221) A. D. S. asks: 1. Why is lead used for plates in storage batteries to the exclusion of other metals? Is there no other metal that will answer the same purpose? A. Simply because, so far, no better combination has gone into extensive use. The Waddel-Entz and other storage batteries have no lead plates, and involve different reactions. Grove's gas battery uses no lead plates and is a true storage battery. 2. Why is red lead used for coating the plates, and is there nothing else that can be successfully substituted? A. In the Plante battery no red lead is used. Litharge and brown oxide of lead can be used. 3. What is the best high resistance wire used, and how can I determine the amount to be used on a multiple incandescent circuit where the pressure inside the transformer is 52 volts, without short circuiting and melting fuse wires? A. German silver and iron wire are used for resistances; but for alternating current work choking coils are often used instead of true resistances. The capacity of wire can be calculated by a formula. See Sloane's "Arithmetic of Electricity," $1 by mail. 4. What is the electrical conductivity of aluminum and lead? A. Aluminum is 10-18 the resistance of copper; lead is 1-12 the resistance.

(6222) C. P. writes: Steam is lighter than air. Then, when the air is saturated, or when it contains large quantities of moisture, how is the weight or pressure of the air affected? At the present time the atmosphere of northern Ohio is very "smoky;" in fact, the sun can hardly be seen, although there are no clouds. People say the smoke comes from forest fires in Michigan; they say they can smell the smoke, yet it does not affect the eyes. Now is this something that darkens the atmosphere real smoke, coming from burning forests in other States? A. Moisture in the atmosphere affects the barometer to a considerable degree, causing it to fall during increasing moisture until rainfall makes a change, when its rising may indicate drier air. There are also wave motions in the atmosphere that intensify or moderate the barometric fluctuations. The smoky atmosphere is real smoke or minute particles of carbon floating in the atmosphere. This, settling slowly toward the earth, produces the haze and foggy appearance observed.

(6223) J. M. C. asks: What is the weight of a cubic foot of air at temperature of 80°? What is total heat of air at 80° in B. T. U.? How many degrees Fah. will one B. T. U. raise one pound of air? How many cubic feet of air will be raised one degree temperature by one British thermal unit? A. 1 cubic foot of air at 80° weighs 0·07356 of a pound. There are 11·4 B. T. units of heat above 32° Fah. in 1 pound of air at 80° Fah. 1 B. T. unit will raise one pound of air 4·2 degrees Fah. 1 B. T. unit will raise 54½ cubic feet of air one degree from 60° Fah.

(6224) E. E. K. asks: We would kindly ask you if you can give any information as to how close to each other double railroad track, are laid in Germany or other European States? It is claimed here by one of our members that passenger coaches pass each other leaving but one foot space between nearest points of coach. A. The gauge of the German railways is 4 feet 8½ inches. The tracks are 11 feet 5¾ inches from center to center, and the cars 10 feet 4 inches over all; leaving 13¾ inches clearance between them by the old government standard. By the new standard the centers of tracks are to be 4 meters or 13 feet 1 15/16 inches apart, giving a clearance of 2 feet 9½ inches nearly.

NEW BOOKS AND PUBLICATIONS.

A MANUAL OF THE DOCUMENTS TO ESTABLISH THE INDIVIDUAL CHARACTER OF HANDWRITING AND TO DETECT FRAUD AND FORGERY, INCLUDING SEVERAL METHODS OF RESEARCH. By Persifor Frazer. Pp. xi, 218. Illustrated. Price $2.

For protection from forgery and from the alteration of checks the study and general examination of handwriting is something which acquires, with the passage of time, a greater and greater importance in the courts and in business life. This little work treats largely of forgery. It gives the points to be noted in different handwritings, illustrates the system of microscopic research by different methods, and makes the subject take an intelligible shape. The subject is a very interesting one, and as treated here makes very good reading for all.

SERVICE DES ANTIQUITIES DE L'EGYPTE. Notice des monuments exposés au musée Greco Romain d'Alexandrie. Par G. Botti, Conservateur. Alexandrie. 1893. Pp. xxviii, 254.

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Yeast, dry hop, Price Flavoring Extract Company ... 25,207

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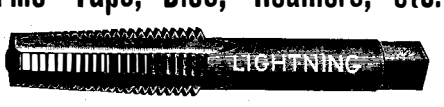

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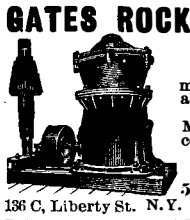

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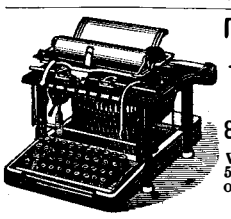

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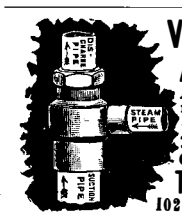

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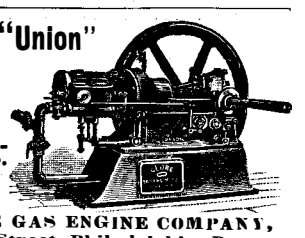

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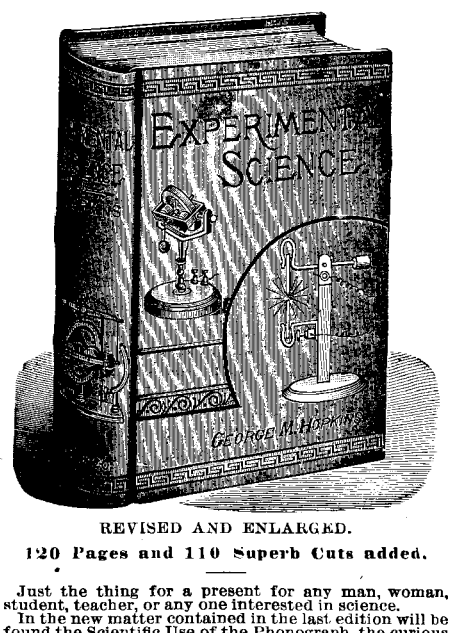

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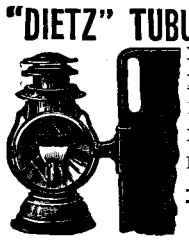

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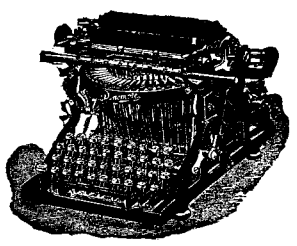

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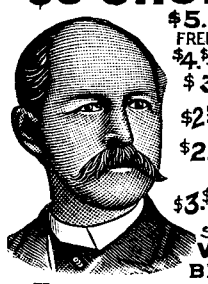

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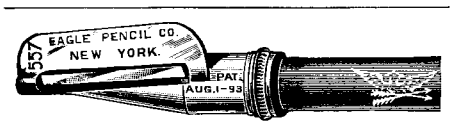

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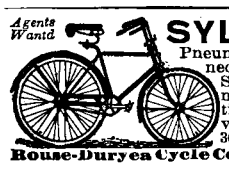

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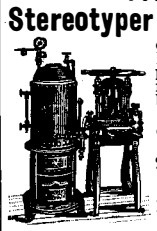

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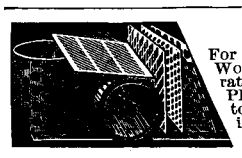

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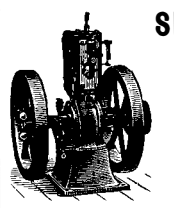

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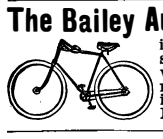

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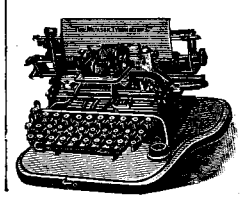

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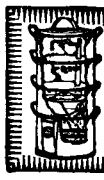

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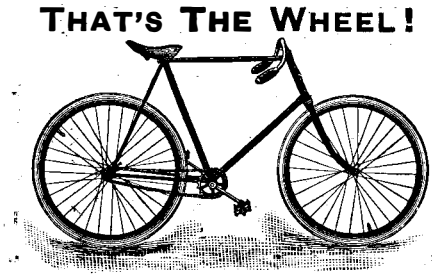

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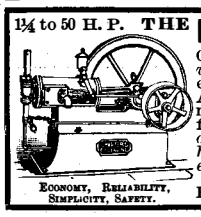

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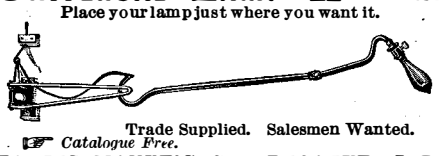

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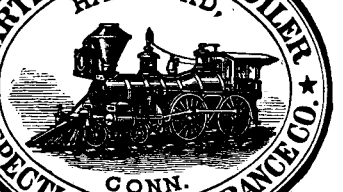

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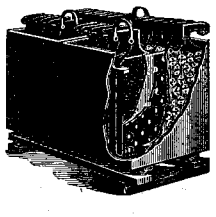

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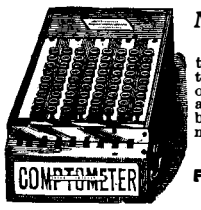

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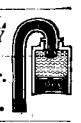

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